



It extends human vision beneath seas, into furnaces and throughout factories.

TELEVISION is adding overalls to its dress clothes. Its sleeves are rolled—it is ready to go to work!

To most of us, television has been a promise of armchair entertainment—a chance to have choice seats at boxing bouts, football games, news events and stage plays without budging from the budget or the living room. That phase of television is here, but television's future goes far beyond the mere prospects of animated quiz shows and soap operas you can see.

Television, like radio, is a versatile tool. A relatively small percentage of the radio waves that flash around the earth today carry music and comedy to our loudspeakers. Most of them have more important missions. Radio helps us go places and do business. Without it, large-scale scheduled air travel would be impossible, sea travel would be slowed, crime prevention hampered, news coverage cut down, and international business and diplomacy limited.

Television likewise means much more to us than an amusing accompaniment for radio's sound. Its workaday uses are even more dramatic than its role as an entertainer.

I found that out when I got a firsthand look into television's future at the large modern laboratories of the Radio Corporation of America at Princeton, N. J. There I put questions to Dr. Vladimir K. Zworykin, director of the laboratories' program of electronic research—one of the men who helped raise television from its flickering beginnings to its present status.

Getting Dr. Zworykin to talk about television was not a hard assignment. He thinks it, dreams it, lives it, and talks about it with parental love.

"Television," he explained, after he had shown me his laboratory, "is an extension of our sight. It gives us a simple means of getting eyewitness views of things happening in places too small, too distant, or far too dangerous for the average person to observe. Properly applied, television can show us many things that we have never seen before. It can open up whole new frontiers of research and knowledge.

"Undersea exploration is an excellent example. Few divers can descend more than 200 feet. Television, however, can put our eyes there without risk to our bodies. By installing a television camera in a thick-walled metal bathysphere, lowered from a survey ship, the deepest ocean floor can be explored safely and for hours at a time by skilled observers seated comfortably in front of a direct-wire television viewer on deck—or on dry land, for that matter, if the television signals from the camera are radio-relayed from ship to shore."

As Dr. Zworykin enlarged on his idea I realized that the construction of such a television bathysphere would present no great problems. It could be similar in design to the diving ball that Dr. William Beebe used in his undersea observations. With thicker walls to withstand greater pres-

sures, it would otherwise be simpler, since a television camera, unlike a man, requires no oxygen and would be unaffected by the near-zero temperatures 600 feet under.

Since scenes have been televised from the dim light of a candle, illumination would not be difficult. The modern television camera using the new Image Orthicon tube, another Zworykin-guided development, is as sensitive to light as the human eye, so floodlights for underwater television exploration would have to be no brighter than those required for human observation. The bathysphere could be lowered by cable, while remotely controlled motors built into a supporting gimbal could turn and tilt its "eye" to scan the surroundings. The bathysphere could be used to aid under-water

on the JOB

By GEORGE H. WALTZ, Jr.





Welding jobs on automobile bodies may be inspected by television in the factory of tomorrow.



Hat metal pours into molds before one of the numerous "eyes" at key points throughout the plant.

salvage, guide the placing of drilling gear for undersea oil wells, assist in submarine rescues, and, perhaps, even test the myth of lost Atlantis. The depths that could be plumbed would be limited only by the strength of the sphere's metal shell.

Similarly, according to Dr. Zworykin, television cameras can give us close-up views of what goes on within chemical rection chambers, inside fiery furnaces and behind the thick lead walls that surround atomic-fission experiments. It provides us with a third eye that is unaffected by lethal fumes, heat or radiations.

What actually goes on inside smelting

furnaces and glass furnaces is still pretty much anybody's guess. The heat is so great that temperatures must be measured from a distance with optical pyrometers, and quick glimpses through jet-black goggles are the only observations possible. Any closer view would sear the flesh, blind the eyes.

Television cameras at strategic spots inside the furnaces could flash pictures of the ficty mass to a viewer in the office of the

From a central television booth, below, and man may co-ordinate all the activities of a great industrial plant. Image viewers enable him to watch every step in transforming him materials into finished product.



Activities extending over more than 25 miles of production lines may be controlled from a central point.





Remote control matches the pace of merging assembly lines, as where body of a car meets chassis.



Viewers instantly detect fire or explosion, speeding alarms, emergency measures, and first aid to injured.

plant engineer. He could watch the process from beginning to end with no more bother than switching his viewer from one camera to another. He could literally "walk around" inside the furnace. The glow from the molten metal or glass would provide more than enough illumination, and liquid-cooled jackets would protect the cameras.

Dr. Zworkin also envisions television as super-supervisor in the large factory of to-

His telephoned orders regulate the tempo of each department so that all work smoothly together. Moster switches at his fingertips permit him to stop machinery, close fire doors and sound alorms.

morrow. Television cameras set up in the various departments of a manufacturing plant would allow one man in a central viewing room to watch, control and safeguard the entire plant's activities, Rows of television viewers would show him exactly what was happening at nerve centers of the factory. His master control room would be an industrial equivalent of the CIC (Combat Intelligence Center) rooms that coordinated our fighting forces along the different fronts during the war. Such a system would speed production and safeguard life and property.

A similar setup on a smaller scale could





A final checkup, before the product leaves the foctory, is double-checked by the television supervisor.



Only a few privileged spectators can look an from as close a paint of vantage as this, while a famous surgeon performs a delicate operation. Medical students have had to watch from a distance.

be used to control the flow of automobile assembly lines. At present, it requires the services of a corps of men to supervise the 25 miles or more of subassembly and main assembly lines that snake their way through most big automobile plants. Television cameras set up at the feeder lines and along the length of the main assembly line and wired to viewers in the main supervisor's office could bring the entire problem under his eyes.

Television may well change our whole concept of educational techniques, Dr.



Reproduced upon auditorium screens, the television pictures of the operation would give every member of the audience a view as clear and detailed as that of the surgeon himself.

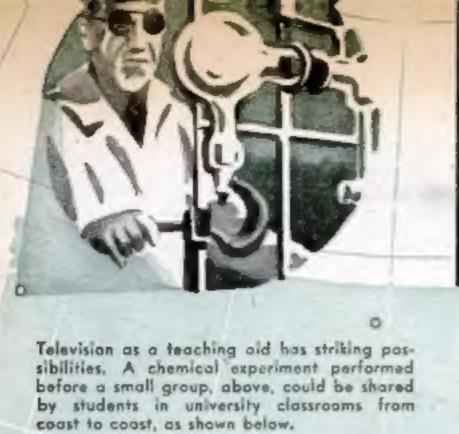
Zworykin believes. This is particularly true in medicine, where a student's view of an operation consists of what he can see from his seat high in the operating-room amphitheater. Television, however, can give him a surgeon's-eye view of the whole proceedings. A television camera mounted in the cluster of lights over the operating table and wired to screens in classrooms would not only give each student a close-up of eyen the most delicate operation but would allow hundreds of students, instead of a few, to watch the demonstration. If put on the air, an operation could be witnessed by students in medical schools all over the

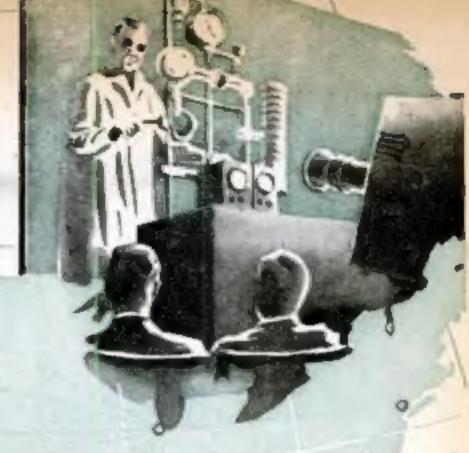


Suspended directly above an operating table, a television transmitter would be in an ideal position for observation, picking up and transmitting what takes place beneath it without missing the smallest detail.

Long-distance diagnosis is another medical possibility. With the aid of television, a doctor and his patient could take full advantage of the knowledge and skill of a specialist a thousand miles away. Public health doctors could make actual television visits to health clinics in outlying districts. Special health lectures could be delivered simultaneously to widely scattered groups.

There is no reason why students some day will not get first-hand televised looks at the moon and stars through the giant Palomar telescope, watch important experiments in progress at the world's great research centers, sit in on the actual proceedings at international conferences, or "attend" any of the firsts in science, exploration and the arts. Famous lecturers and educators could be















Television cameras with cooling jackets can disclose what happens in smelters, glass furnaces and other places where terrific heat precludes a direct view.

seen and heard simultaneously in schools all over the country.

Television as a teaching aid was dramatically demonstrated in New York City during the war when first aid and fire-bombfighting methods were explained to the city's volunteer air-raid wardens via the television camera. Viewers set up at air-raid posts throughout the city made it possible for a single group of civilian-defense experts to demonstrate air-raid procedures to more wardens than ever could have been jammed into the city's largest auditorium. And what is more to the point, every warden had a close-up of the demonstration.

I asked Dr. Zworykin if he thought it would be possible to equip news reporters with lightweight television cameras that would allow them to broadcast on-the-spot

views of accidents, fires, train wrecks and similar news events. As an answer he showed me the compact, lightweight television camera that has been developed for use guided rocket. a Weighing only 34 pounds, and no larger than a suitcase, it may well be the forerunner of the newscaster's "walkie lookie." It would have to be changed only slightly. Its compact transmitter and power supply, stowed in the reporter's car, would transmit the scene being televised to a main broadcasting station. There a picture editor, seated before a bank of viewers showing the individual pickups from perhaps a dozen reporters on their beats, could select the events he desired and rebroadcast them to the station's television public.

Several department stores are experimenting with direct-wire television as a means of displaying merchandise to customers. Fashion shows, displays and special skits to demonstrate kitchen and garden equipment are televised and piped to viewers placed in the store's windows and at eye-catching spots around the store. In a sales test run by one large Eastern department store a poll of the customers showed that nine out of 10 felt television was an aid to their shopping.

Television billboards are the latest advertising wrinkle. The plan, conceived by a Boston, Mass., outdoor advertising firm, calls for a network of large outdoor screens to display television sales programs broadcast by a central station. Set up on roof tops and on the sides of buildings, the television billboards will offer a variety of entertainment interspersed with commercials.

A New York bank is considering installing a direct-wire television system to speed up and simplify the identification of customers. A viewer at each teller's counter connected to a camera at the identificationcard files will allow him to verify signatures

and bank balances without leaving his window. A similar network for the nation's police forces would speed identification of criminals by photos and fingerprints.

New developments still in the laboratory—such things as three-dimensional and fullcolor pictures — will extend television uses even further,. Dr. Zworykin believes. Fullcolor television alone, for example, will greatly simplify the accurate matching of colors in the paint, dye and textile industries.

In the meantime, television as we know it today can go far to help industry solve its problems.

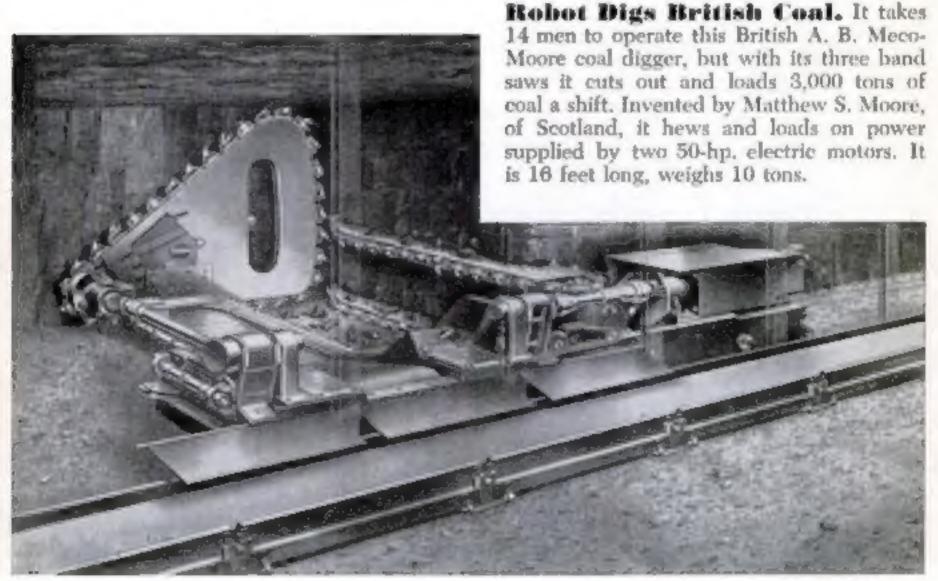
CHINI DOMESTICS



COVER. Undersea exploration with a pair of television bathyspheres. Pointing by Ray Pioch.

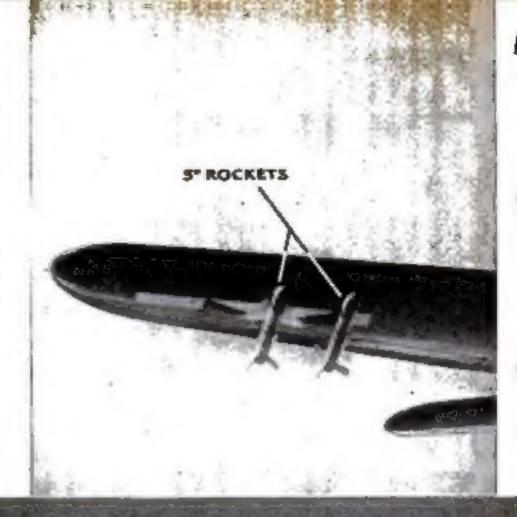


Auto Sprouts a Wing. It's not a style for the everyday motorist—but it's a style that will do the everyday motorist a lot of good. The car above with the fin sticking out at its side is testing United States Rubber Co. tires on the bed of a dry lake near Lancaster, Calif. As can be seen at the left, the fin is a section of an airplane wing. It exerts inward thrust to offset centrifugal force on curves and allows the car to rip around a five-mile circular track at 90 m.p.h. as if it were on a straightaway.



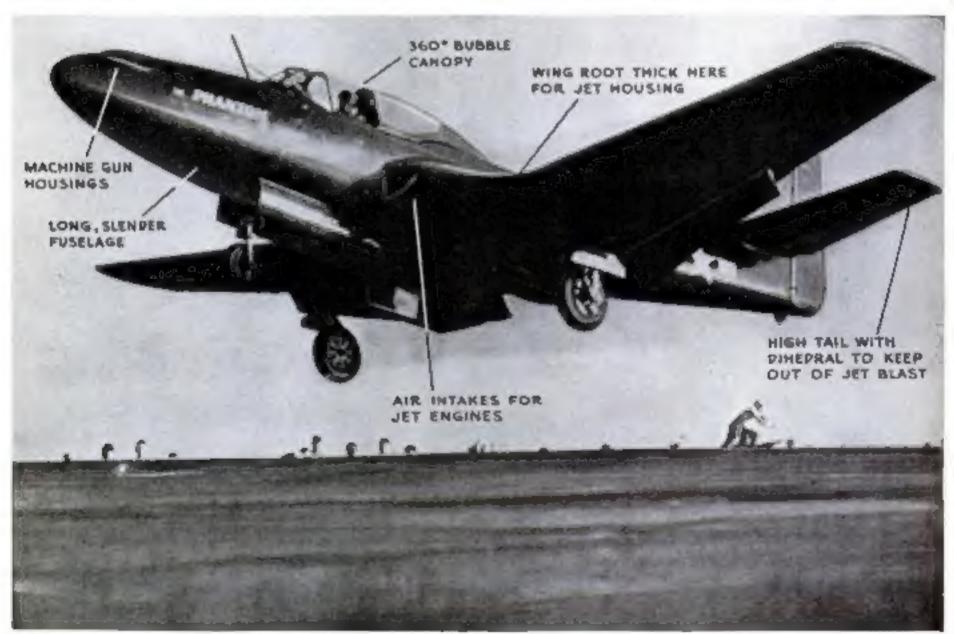
EVIDENCE that the Navy is passing up no bets in the jet-propelled aircraft field was presented recently when two new jet fighters—the XFJ-1 and the XF6U-1—the fastest planes in the Navy's sky armada, were unveiled. This pair of jets, the Navy says, are peers of the Army's Lockheed P-80 Shooting Star and Republic P-84 Thunderjet. Furthermore, the Navy has announced the XP4M-1, a jet-plus-propeller, land-based patrol plane, built by The Glenn L. Martin Co. A long-range, high-speed craft, it recently made its first test flight.

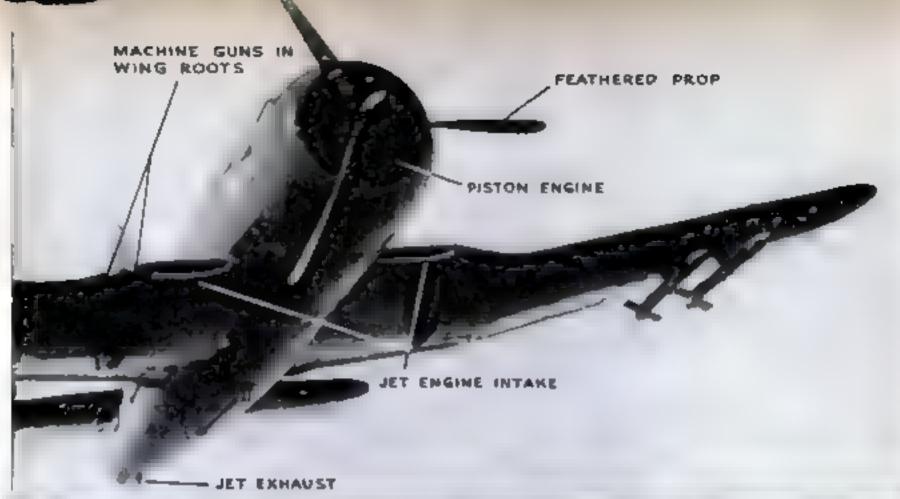
First use of jet propulsion by the Navy was in this Ryan FR-I Fireball fighter, right, which combines a jet engine and a piston-type power plant.

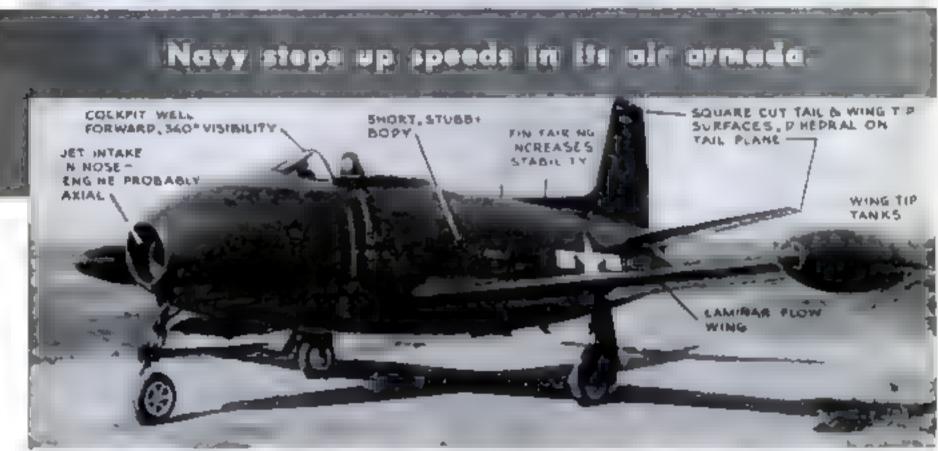


JETS Go to Sea

After Pearl Harbor, experts began work on plans for the Phantom, below, first all-jet Navy plane. Today's faster Navy jets are all follow-ups of the pioneer Phantom, which was built by McDonnell Aircraft.

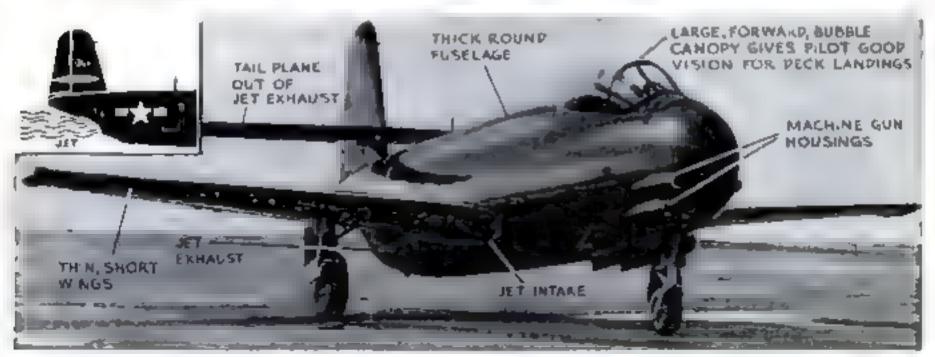






Built by North American, the XFJ-1, above, has a General Electric jet engine that gives it a speed well over 500 m.p.h. When carrier-based, the lighter is launched by a catapult. Wing span is 38 feet; wing-tip fuel tanks can be jettisoned.

In the XFJ-1's spend class, the Chance Vought XF6U-1 below, is powered by a Westinghouse jet unit. With a wing span of 30 feet, the fighter is made of metalite, which sandwiches a balsa wood care between two thin aluminum-alloy sheets.





By DEVON FRANCIS

THE world will take a hitch in its belt in the next few months. Passengers on commercial air lines, at long last, will be able to fly across the top of the world—the shortest distance between the world's most populated places. One such route has been approved. Others will be.

For the person who buys a ticket to Stockholm or Tokyo, Arctic and sub-Arctic flying will be pioneering in the sense that riding the air lanes in Ford trimotors 20 years ago was pioneering. In the winter the Arctic is the womb of storms. Pilots say that sometimes it's like flying in a bowl of milk—the visibility is that bad. Cabins will have to be heated to withstand temperatures skidding to -50° F. Good hotels will have to be built a thousand miles from nowhere to accommodate passengers if the weather closes down. (And they probably will have to be air conditioned in the summertime; at some points in the Arctic the tempera-

tures climb as high as 100° in the shade!)

All this doesn't mean that flying in the Arctic and near-by regions will call for special during on the part of the passenger. Neither will be have to rush off to Abercrombie's for a parka or an explorer's sleeping bag.

For the air lines themselves, flying Arctic routes will be something less than pioneering. As contract carriers for the government, they flew over the top of the world during the war. So did the Army and Navy.

Wartime there of the far north learned to combat extraordinarily heavy ice formations in flight, windblown "horizontal snows," violent Aleutian storms called "willtwaws," Alaskan steam fog, and "sea smoke" that blotted out a view of the wing tips even in a 60-mile gale.

But the routes were established. The Army Air Forces Air Transport Command did much of the work.

Starting in 1941 the ATC network of bases on the European leg expanded from



Eloquent evidence of the force of the Aleutian winds is the twisted, 3,500-square-foot, eight-ton steel runway matting at left. A gale from the Bering Sea whisked it up from where it had been frozen into the rocklike sub-Arctic ground at an Army Air Forces base on Amochitka Island and tortured it into its grotesque shape.

the solitary base at Gander Lake, Newfoundland, to more than 20 new airdromes and establishments for communications, weather observation, aircraft servicing, and housing of personnel in Newfoundland, Labrador, Baffinland, Greenland and Iceland. Some of these bases have been made available to the commercial lines.

On the route to Asia, the ATC pioneered the 24-hour Seattle-to-Tokyo run, over which C-54 Skymasters are trail-blazing by carrying mail and cargo on the new 4,880-mile Great Circle course, via Adak in the Aleutians. Almost 3,000 miles and 16 hours' flying time are cut from the old dog-leg route across the Pacific through Hawaii and Guam. Northwest Airlines has been authorized by the Civil Aeronautics Board to establish passenger service, but no travelers will be carried until air crews become thoroughly familiar with the Aleutian weather and terrain.

Arctic commercial air lines require accommodations and expanded facilities that were not absolutely essential at the time ATC was carrying high-priority passengers and cargoes to Europe and Asia to expedite our war effort. Then it was a case of overcoming the U-boat menace and getting planes and people and material to the battle zones as quickly as possible. Today it is a case of safety, comfort, speed and cost, in that order.

Air travelers who fly these routes will find a great airport at Goose Bay, Labrador, and will see how Greenland's BW-1 base (short for the airdrome's code name, "Bluie West 1") practically snuggles between the mountains and the foot of a great glacier.

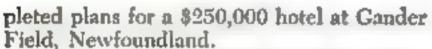
Some of the facilities are marvels of engineering. Sites for the airdromes were scouted from the air, with the reconnaissance parties looking for river-bed locations between mountain ranges, because these usually had an eroded gravel base. But such preferable sites could not always be found. Goose Bay, for example, was built on a huge sand delta. Harmon Field, located at Stephenville on Newfoundland's west coast, was put in shape only after muck and peat 20 feet deep were excavated and replaced by a hard fill.

Arctic travelers will have the benefit of delicate weather forecasting. The men of the AAF 8th Weather wing originally set up and manned the network of Arctic stations. In addition to forecasters, who predict conditions in advance of flights, each station required a staff of weather observers and "rawinsonde" technicians (PSM, Jan. '46, p. 71), who measured and recorded atmospheric conditions in their respective regions. Weather-reconnaissance planes, carrying special instruments and observers, made long flights and brought back data that was fitted into one big weather picture of existing and predicted conditions.

One of the world's most extensive hotel systems was operated by ATC, and the now-famous "Hotels De Gink" had "all the comforts of home." Every base had its Hotel De Gink for the flood of passenger traffic that developed during the war. Only a few of these establishments would be fancy enough for paying passengers in peace-time, however, and the commercial lines are planning their own passenger accommodations. American Overseas, for one, has com-



For worming up clipper engines in Alaska, Pan American uses 262-pound "fire pots," which are placed under the torp-covered power plants.



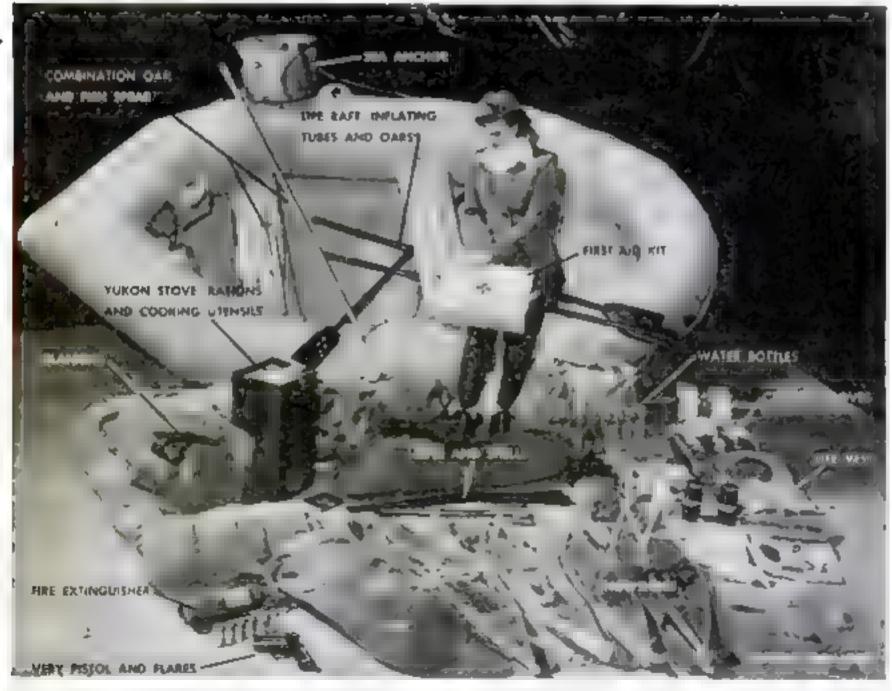
Air travelers to the sub-Arctic area will see buildings arranged in unusual patterns, as well as houses, hangars and other buildings built on heavy pile foundations. Frozen ground is not the firm foundation its hardness would indicate, and earth that is underlain by permafrost (PSM, Nov. '46, p. 126) can heave and settle to such a degree that houses and buildings quickly collapse.



Once a military beekive, Gander Field, Newfoundland, is now a commercial field with accommodations including lounge, restaurant and cocktail bor.

Three-fourths of the earth's land and nine-tenths of its population are located above the equator. Moreover, the capitals and trade centers of the most important powers are north of the 37th parallel.

Commerce and military strategy must necessarily be concerned with the location of these population centers. And the routes that connect the United States most directly with them are over the Arctic and sub-Arctic regions.



Stewardess checks 286 pounds of emergency equipment carried by Pan American on all Alaskan flights, 78 science

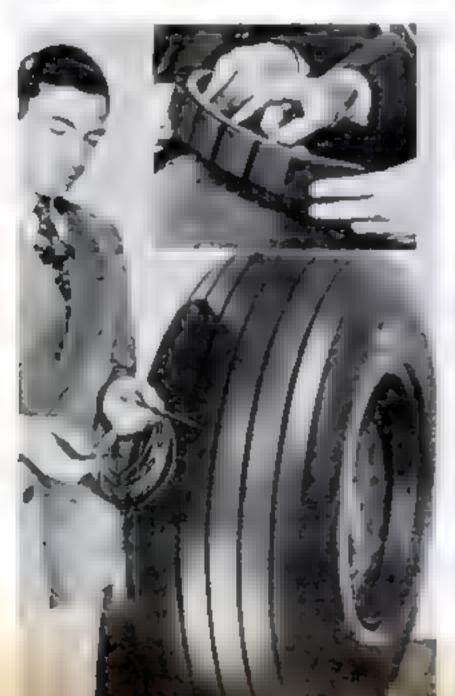


Two-Minute Car Washer. When a car emerges, show and clean, from this tunnel of tubes, it has spent no more time in getting a bath than it would in getting its gas tank filled. Air from the pipes evaporates

Plane Tire Made with Wire. By using steel wire cord under the tread, it is possible to make airplane tires smaller, yet able to carry greater loads, according to the U.S. Rubber Co. An experimental tire is pictured below with a coil of the steel cord

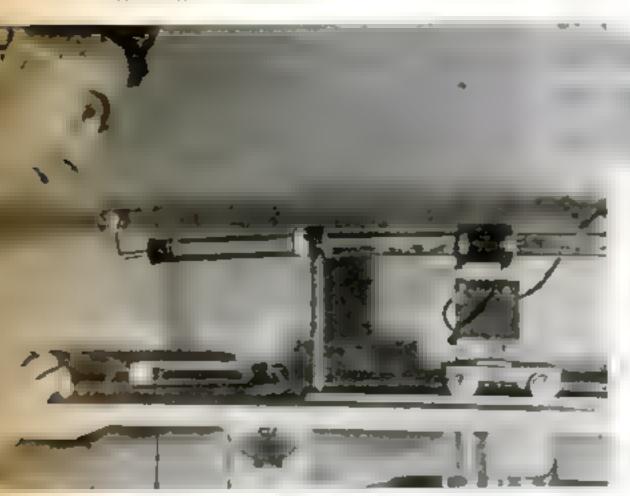
all moisture after the car has passed through a stall (extreme right) where it had a onceover with soft, water-flushed brushes. Commerce Pattern Foundry and Machine Co. manufactures the automatic washer.

Hazooka Turne Pitcher. Using the tube of a bazooka he carried during the war, Pete Wald, a New York optometrist, devised the mechanical baseball pitcher shown below. The tube carries the balls to a motor-driven throwing aim









SCIENCE

Dubbed the "railway engine," a tube left) at Smithdown Hospital in Liverpool, England, is filled with sawdust infected with malaria germs. To corral the parasites for study, an electrically heated, mobile coil fits around the tube and moving from right to left, drives the germs before it to the end, which is free of sawdust

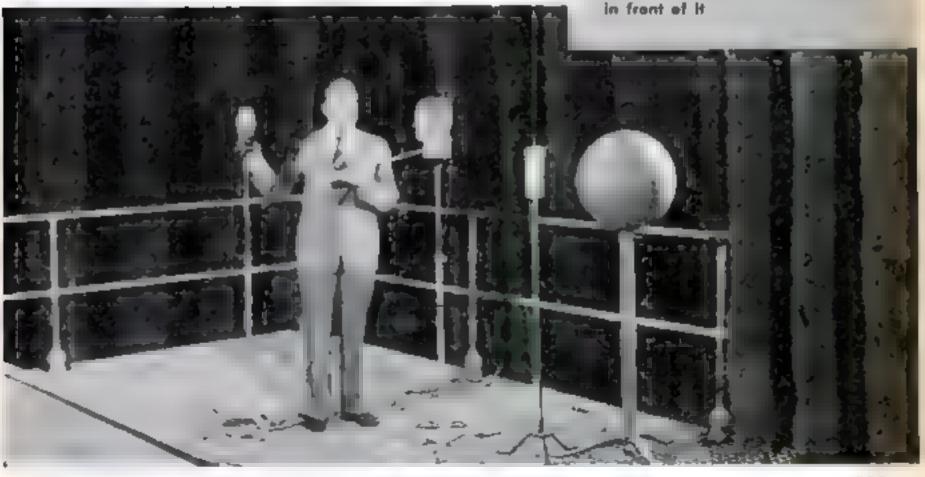
Hox Fortures Plastic. Under temperatures from -50° to 200° F., Westinghouse tests Micarta plastic in the box at right. An engineer measures one of two pieces preparatory to subjecting them to a strain test in which they will be vibrated 15 times a second for three months

* Iberator Tests Tubes. When General Electric wants to try out electronic tubes for home and aircraft radio receiving sets, it gives them a terrific shaking up on the vibrator below. The machine jerks the tubes back and forth 25 times a second for 100 hours—9 000,000 shakes. Blurred outline of the tube in the picture includes the rate at which it is vibrating.



RADIO'S "DARKROOM."

Because its walls are fined with acite fine and its floor" is covered with a steel grating that rests on rubber pads, an ache hosn't got a chance in the "free-field" sound room shown below RCA uses the three-story chamber to study acoustics. A microphone is concealed in the mouth of the dummy head, and during experiments it simulates an announcer talking into another microphone, being adjusted in freet of it

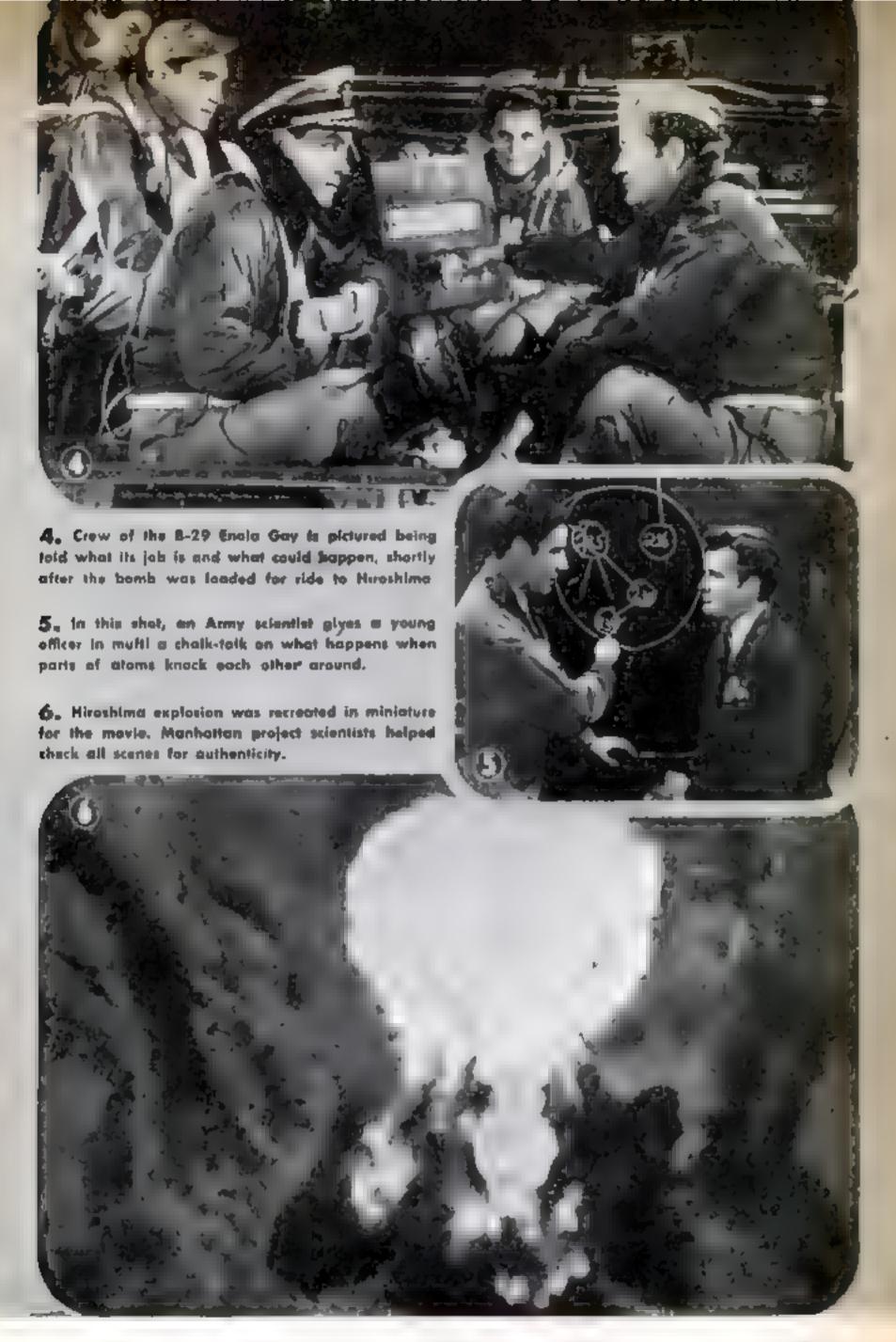




2. Actor, cast as Dr. J. Robert Oppenheimer, receives first uranium 235 refined at Oak Ridge from Army courier at Las Alamas, N. M., laboratory, near site of the first explasion of the A-bomb,

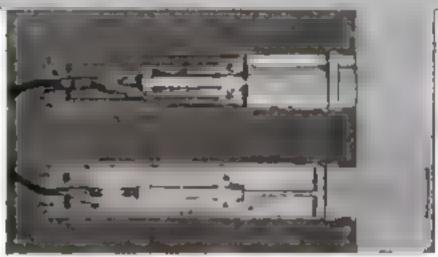
3. Scientists are depicted removing eye shields at desert observation post as glare from first atomic blast fodes in the early down of July 16, 1945.





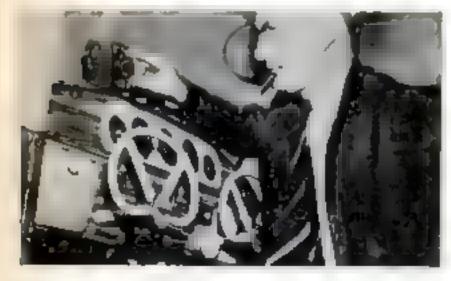


L-13 FOLDS ITS WINGS. When lowed on the ground, L-13's wings can be folded and its landing gear turned inward. In the air it can be towed, g iderlike, then released under its own power.



AILERON MECHANISM. Interior view of mechanism (above) on navel wing-tip aileron for a Fairchild pilotless aircraft shows alleron retracted [at top] and extended (at bottom).

"SKY HOOK" SPEEDS LOADING. Among many innovations for handling of cargo on the new Booing Stratofreighter is a monorall power hoist (below) that handles 21/2 tons at a time.



SIGHT AIDS LANDINGS. With a new landing sight, above, a pilot has only to set three dials—for glide speed, load and wind. The sight tells him when to cut power and where plane will land,



84 SCIENCE



RESCUE PLANE. The amph bion XJL-1 (above) was built by Columbia Aircraft for Navy search and

rescue work. It has a 1,435-hp. engine and jet assistance for take-offs. Top speed: 200 m.p.h.





JET LIFTS GERMAN GYRO. Jet exhaust piped to the rotor tips is used by the WNF-342-V4, below, to climb, descend or hover. A small conventional engine at the rear of the fuselage powers a pusher propeller to provide a slipstream to improve directional control. It gives a 25-m.p.h. forward speed when tail elevators are tipped. AAF hopes to increase speed of the German-built craft by adding another pusher propeller.



GLIDER NEEDS NO WINGS. The G-E Gyro-Glider at right has neither motor nor wings. As a jeep tows it to provide launching speed, the pilot is gresping the overhead controls that change pitch of rator blades. The Gyro-Glider can lift about 300 pounds in addition to its own weight and is able to land in very small areas. General Electric built it.

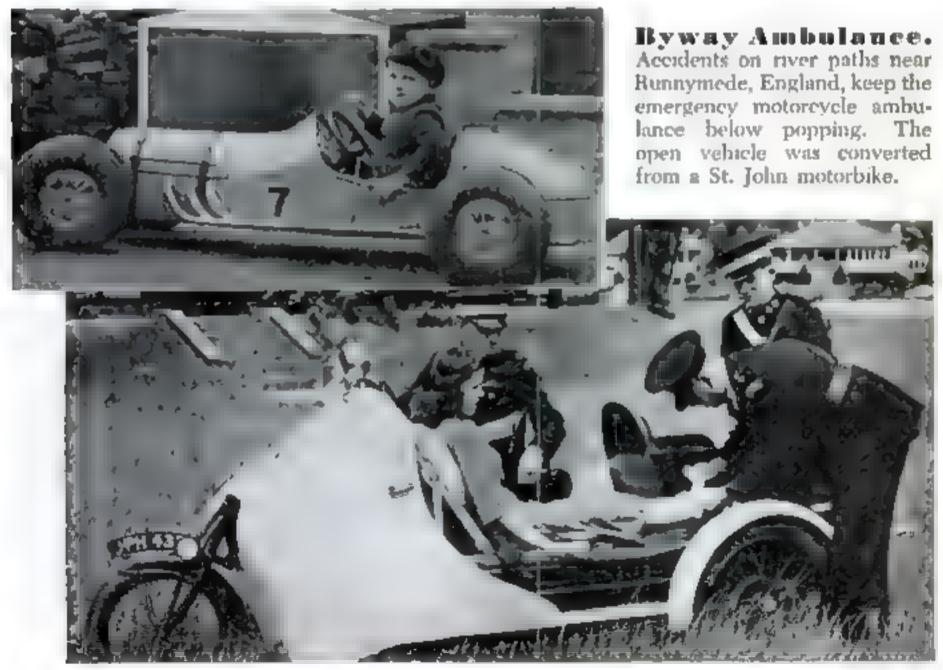


BIGGER BENDIX CARRIES FOUR. The helicopter on the ground, above, is the new four-place Bendix "J." It has a 450-hp. Pratt & Whitney engine, and two main rotors that turn in apposite directions. Helicopter aloft is the ane-place Bendix 'K'





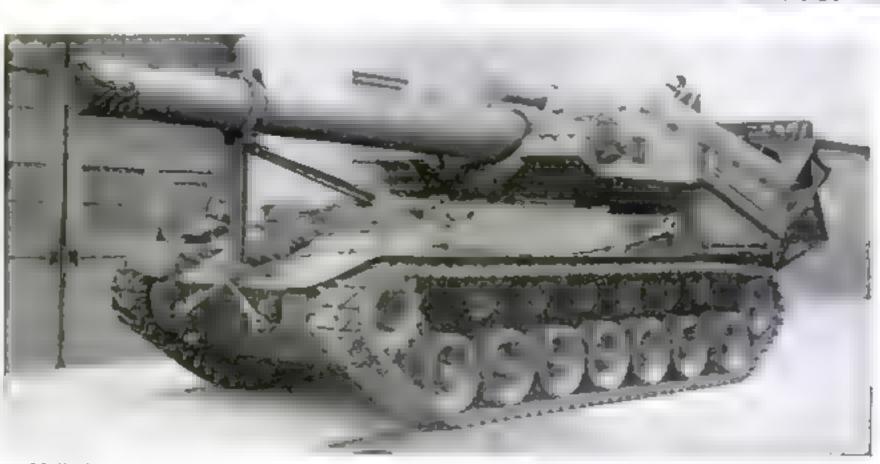
Electricity Runs Model Racer. Roger Brown, of Meriden, England, sits in his electric model of a Grand Prix racing car, below. Built by his dad, an engineer with Nuffields, British car manufacturers, it is five feet six inches long.

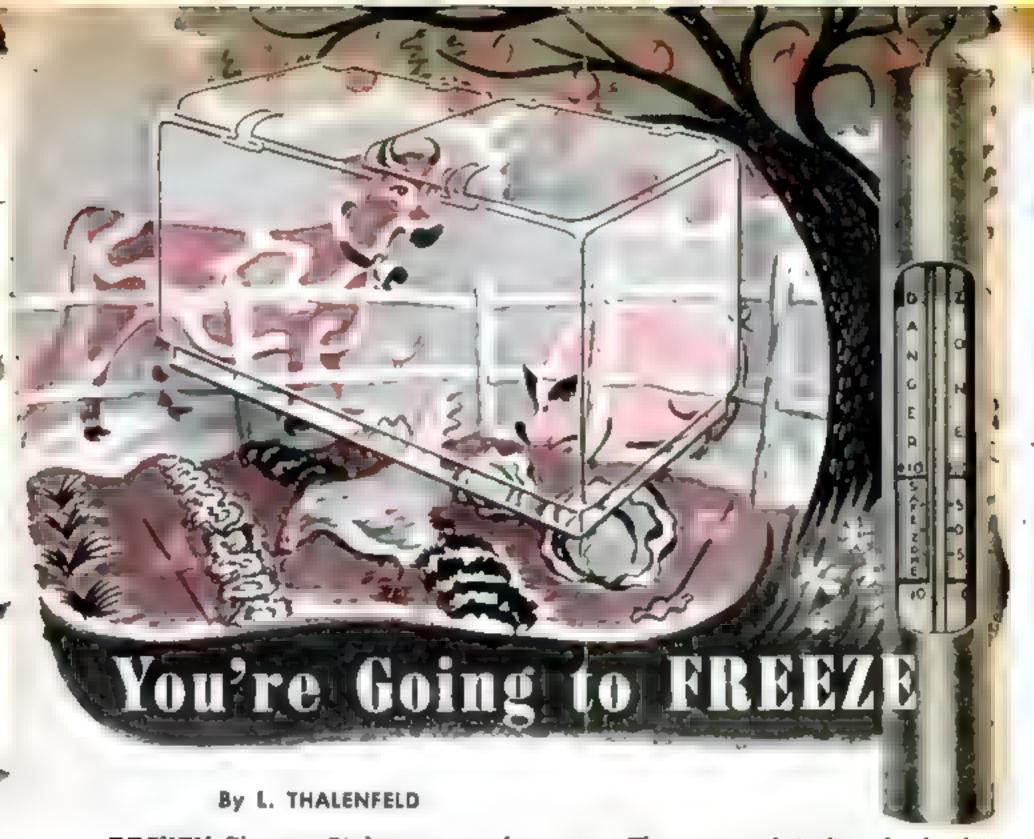




Mud Slinger. In action, the Standard Dredging Company's 110-foot suction dredge, shown at left without its cutters, can scoop out a 55-foot-deep river's bottom and deposit it on the bank at the rate of 2,500 cubic yards an hour. It is working on the Atchafalaya river channel.

Tank Totes Big Guns. A new 63-ton, tank-type battlewagon, developed by Chrysler for the U. S. Army, mounts either an eight-inch rifle (right) or a 10-inch howitzer (below), and can be set up for action in five minutes. A spade tail is sunk into the ground to buck recoil. The rifle fires a 240-pound shell 27 miles, the howitzer a 360-pound missile 16 miles. The rifle's barrel is 35 feet nine inches long; the howitzer's is 27 feet seven inches.





WHEN Clarence Birdseye was a fur trader in Labrador he tossed a frozen fish back into the water. Astounded, he watched as it revived and swam away. This gave him the idea of quick-freezing food to preserve it—an idea that has grown into an industry that expects to change the home life of 3,000,000 families every year.

Already, 800,000,000 lb. of frozen food are being sold annually—enough to supply the people of the State of Washington with fruits, vegetables and meats for an entire year. And this is only the beginning. Because food can be frozen in a third the time and with half the effort required for canning, more and more food will be preserved by freezing from now on. Freezers will soon be as commonplace as refrigerators.

A home freezer, in fact, is just an overgrown electric refingerator. Both have a compressor driven by an electric motor, and an evaporator with coils. In automatic refrigeration, the refrigerant, generally Freon 12, is compressed and sent through the evaporator coils in the ice-cube compartment. The gas expands in the coils, absorbs the heat inside the box, and lowers the evaporator's temperature to 20° F. Food stored in a refrigerator keeps fresh for about a week at 40° F., the temperature normally maintained in the food compartment.

Some refrigerator manufacturers are producing freezers and using the same compressor for both. As a freezer's insulation is much thicker, the frigid air gets less of a chance to escape, and the freezer "coasts" longer than a refrigerator

The cost of operating a freezer is about equal to that of a refrigerator. A farmer with an 18-cubic-foot freezer-about three times larger than the average household refrigerator-reported that his electric bill had not increased more than \$2 a month.

There is talk of cutting electric bills when Freon 22, a brother of Freon 12, appears. Freon 22, with a boiling point of -41° F., 20 degrees below that of Freon 12, will save money by freezing food faster.

Anyone buying a freezer today has more than 300 brands to choose from, a different



The Kelvingtor freezer features a corresion proof liner and coils attached to all four walls of liner

picture from 1937 when freezers were homemade or custom-built.

The model of freezer purchased should be based on where the buyer lives, the size of the kitchen, and the amount of food to be preserved. Three general types of freezers are available now. The manufacturers admit that none of the existing designs is wholly satisfactory, but add that keen competition is bound to bring improvements—soon. One model is the old standby, the refrigerator, brought up to date by the addition of a low-temperature frozen-food storage compartment. Another is the chest type, with a lid on top. The third is the upright type with



Philoo's five-cubic-foot freezer has three sections, one for freezing and two for storing food.

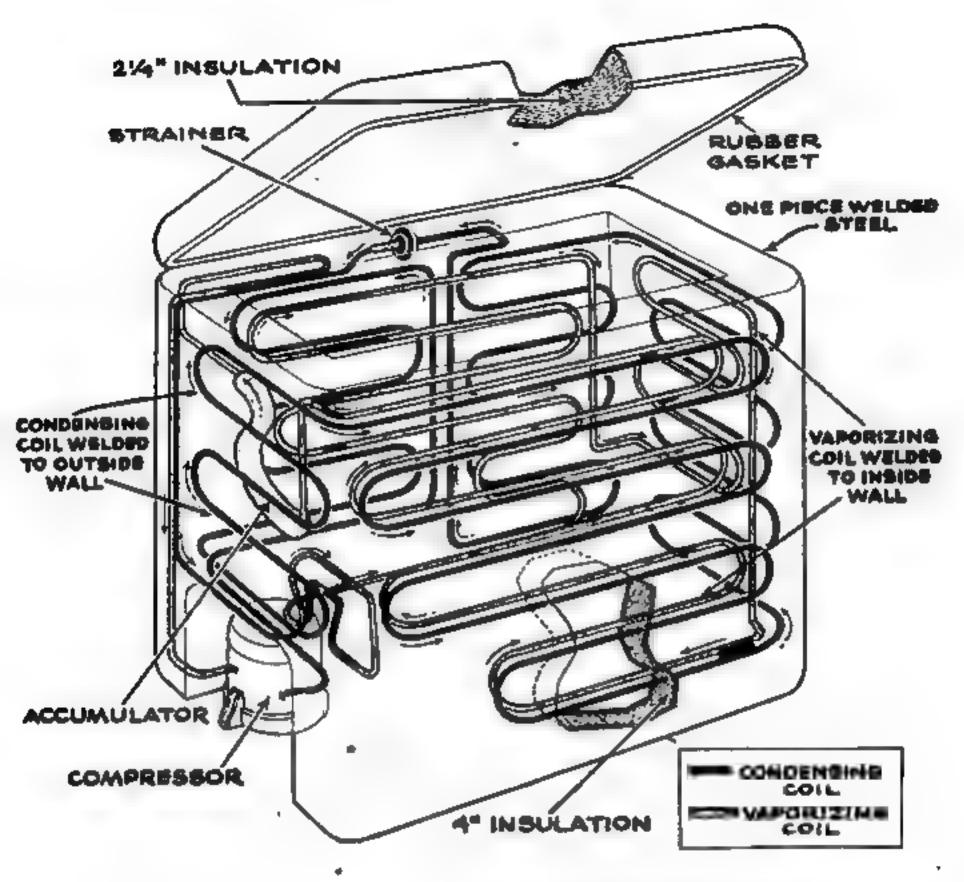
a front-opening door. The last two usually have space for quick freezing and a comparament for frozen food storage.

For a city apartment dweller with a pintsize kitchen, the dual-temperature refrigerator with storage space for a week's supply of frozen food should suffice. A suburbanite with a kitchen garden, however, will want a freezer hig a nough to put up a winter's stock of food—a six- to nine-cubic-foot unit holding about 300 pounds should be ample. On a farm, a year-around food supply probably will come out of the freezer, and the supply





The General Electric model on the left freezes and stores food in top section. Battom is regular refrigerator. The large size Coolerator on the right stores fruits and vagetables, has removable bin dividers. 90 SCIENCE



Cutaway drawing of Kelvinator freezer shows features contained in many modern home freezers.

of energy available should set the size of the box.

In buying a freezer it should be kept in mind that if it's more than 29 inches wide it probably won't go through a house door.

The freezer with a lid on top costs less because it is more economical to build than the model with a front door. The lid type doesn't frost as much, either, and frost is the bugaboo of freezer operation. Frost is caused by what refrigeration engineers call "cold-air spill." In a freezer, cold air falls to the bottom, and the temperature is highest at the top. When you open the lid on a chest freezer, less cold air rushes out than when

the whole door opens on an upright freezer. But since a freezer is opened on an average of only twice a day, as compared with the 40 times a housewife goes to the refrigerator, the loss from cold air spiling out and hot air pouring in does not amount to five cents a month. Also, a refrigerator has to be defrosted every other week, and a freezer but once or twice a year

One drawback of the chest freezer is that it may be hard to find food in it. In the vertical freezer, the frozen food is as readily accessible on the shelves as it is in your refrigerator.

One of the points to check when shopping

for a freezer is the thickness of the insulation in the walls. Freezers are usually insulated with glass wool or cork, and more recently with cellular rubber, which is twothirds lighter than cork. The freezer with five inches of insulation is the best buy. If there is less than four inches of insulation, cold air inside the box escapes and hot air is



Closed, the Maytag freezer provides on enomeled work table with a drop-leaf dinette board.



Here is one of the four models of Coldspot home freezers sold by Sears, Roebuck and Co. stores.

92 POPULAR
SCIENCE

absorbed. Two freezers, identical in every respect except insulation thickness, were tested in a research laboratory. The cabinet with five inches of insulation cost \$1.78 to operate, while the freezer with an insulation of only three inches ran the bill up to \$2.54.

One of the greatest hazards in home freezing is overloading the box with food to be fruzen, creating a rise in the freezer temperature. The food may spull before it is brought down to 32° F. A few degrees above zero in the storage compartment can cause fruits to discolor, vegetables and fruits to lose vitamin C, and meat fats to turn rancid.

The best insurance against temperature variations is to make certain that your freezer has a thermostatic control, so that the temperature in the freezing compartment can be brought down to -20° F, for sharp freezing, while the zero storage temperature is controlled in the rest of the box.

What happens if a storm cuts off the power that operates a freezer? If your unit is well constructed, there is little need to worry. No thawing will occur for about two days, if you don't open the freezer and if it is well packed with fruzen food. For longer periods, fill the freezer with dry ice.

One scheme for rescuing thawing food from destruction is attributed to Boyden Sparks, author and home-freezer authority. For protection against a sudden blaze, he kept a couple of carbon dioxide fire extinguishers in his house. During a hurricane which disrupted the power, he opened the cabinet, turned on one of the extinguishers, squirted the box full of CO₂ snow, and saved the day.

As a precautionary measure, your freezer should have an alarm system—preferably operated by batteries—set to ring before a dangerously high temperature is reached.

Although there's a freezer unit in the White House, you needn't be President to enjoy the benefits of a subzero grocery store in your own home. Prices now range from \$150 for a two-cubic-foot model to about \$600 for a 15-cubic-foot combination freezer and storage locker. As production increases, the cost is expected to decrease.

Practically all meats and fruits can be frozen successfully. Almost any vegetable survives the zero temperature, except lettuce and tomatoes which become limp when thawed. Cooked foods can be frozen, too, so a housewife can now cook the family's meals for a week in one day, and store them away, ready to heat and serve.

END

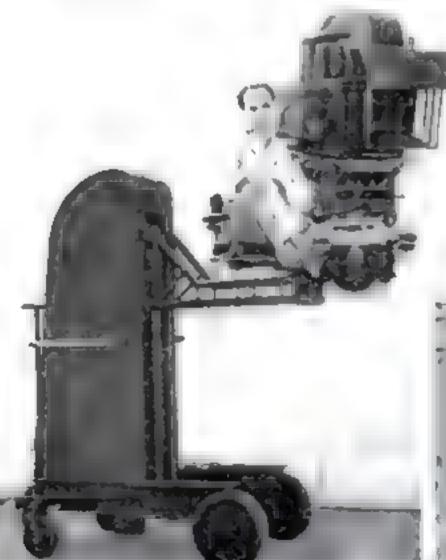


Smaller Motor Is Huskier. The streamlined electric motor on the left, above, is one-third smaller than the old east-iron model at its right, but the new motor has 134 percent more turning power per pound of weight. Made by Westinghouse and called the Lifeline, it is the first all-steel model available to industry.

Closeup moving-picture action shots pose no problem for the 1,000-pound camera dolly below. Electrically powered, it mises and lowers the camera as much as four feet and swings through a 290° arc. Controlled through foot pedals, it has a hand-set brake that holds the camera where wanted. It is built by Houston Corp., of Los Angeles.

Mailbox Shows Contents. There is no need to open Colomat's new transparent Lucite mailbox to see if there's anything inside. It comes in various colors.

of three new Finch FM-AM and facsimile radio receivers, the table model below comes in different woods to harmonize with varied styles of home furnishings. The receiver reproduces facsimile at the rate of four 8%- by 11-inch pages every 15 minutes. According to W. G. H. Finch, president of Finch Telecommunications, Inc., 12 or more cities will be broadcasting facsimile on FM channels early this year. These cities include New York, Chicago, Detroit, Los Angeles, San Francisco, Cleveland and San Bernardino, Calif.





How PHONOGRAPH

RECORDS are made

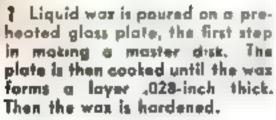
PSM Picture Story by ROBERT F. SMITH and HARRY SAMUELS

THE silent black disk that makes noises when needled is chiefly shellac, lampblack and limestone. In its manufacture, however, pure gold, wax, glass, copper, nickel and sometimes chromium are used by the craftsmen who operate the intricate

and delicate machines that squeeze sound into a scratch.

From beginning to end, the commercial manufacture of records is a tremendously exacting process. For example, 50 percent of the wax-coated glass disks on which the music is recorded are rejected before reaching the cutting room. The accompanying pictures tell the story.





4. Center of vertical disk in background is a gold sheet (cathode) from which the wax disk, resting on a plate (anode), gets its gold



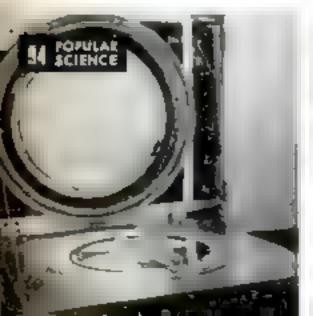
2. Here music is recorded on the wax disk. Sounds picked up by the amplifier create electrical impulses that vibrate a sapphire stylus. The stylus cuts spiral grooves with wavy sidewalls. Cutting is watched through a microscope.

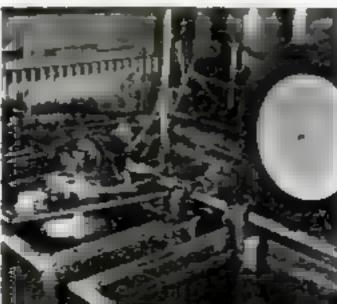
5. Another metal plating applies a crust of copper .035-inch thick to the goldcoated wax. At left, a motor spins e disk as it is plated. At right, a disk finish via an 1,800-volt charge. rests on a hinged board after plating.

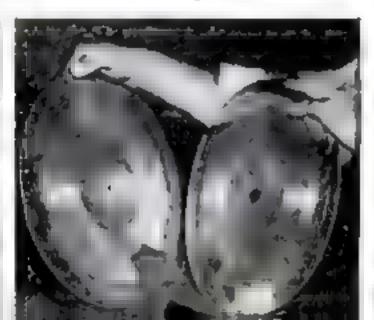


3. Cut with 88 to 136 grooves to the radial inch, depending on the length of the recording, the wax is put in a vacuum chamber to be 'sputtered" with an extremely thin cost of 24-kerat gold.

Plate is split and glass-wax core is broken from the gold-faced capper plate that now becomes the No. | master, Master has ridges









7. Here No. 1 mold, made from No. 1 master, has just emerged from a both in which it acquired a thin plate of nickel to harden its face. A similar coat of copper completes the mold. Moster and mold are still attached.



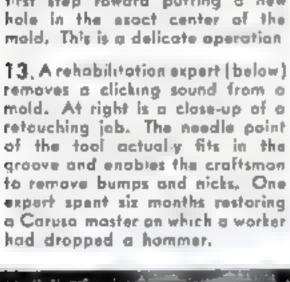
8. A separating tool detaches moster from mald. No. I mald's face is an exact duplicate of the original recording. By subsequent plating and separating operations, No. 2 moster is made from No. I mald and the final mold, No. 2, from No. 2 moster



9. Separation is now complete and No. I mold is ready to be used to fashion No. 2 master. The stamper, which presses the final product the commercial record—is made from No. 2 mold.



10. The mold has an imperfect center hale. Here a craftsman tolders a plug to the back of the nickel-faced copper moid in the first step toward putting a new hale in the exact center of the mold. This is a delicate operation





Through a microscope mounted on a centering machine, the operator can adjust the placing of the disk so that its grooves run true around the center of the supporting plate. In the operator's left hand is a lever that he pulls to punch the hale when disk is centered.



12. The mold can be played. Here an expert listens to ans in the RCA-Victor department where original masters are made. A defect in a recording is marked at its exact spot on the mold.

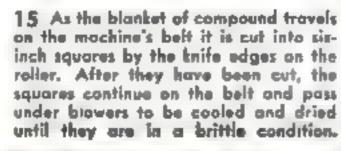








14. Production of phonograph records starts with the mixing of a compound—shel-ac, lampblack and limestone—from which records are made. Here a machine rolls the mixture into a long blanket.



16. At the end of their journey, the squares are stacked for future use in the record-pressing room. Lampblack is added to the compound out of which the squares are made only to give the finished record its color.







17. In the pressing room enough squares to make a record are placed on a steam table and heated until they are plant. Pressing-machine operator folds the square to make a "biscuit," as the trade calls the presser compound.

18. This is a pressing machine about to make a record. In the top section is the stamper for the B side of the record. Its label is an the spindle in the center. In the bottom section is the A-side stamper, its label barely visible under the biscuit. In foreground are labels and the tool used to lift the record.

19 Here a record is made in the presser, a machine resembling a waffle iron. Pressing is done automatically. Steam at 310 degrees F. heats the stampers and the compound is forced into the Impressions on the stampers by a pressure of 1,800 pounds.

20 The press is opened and a record, now nearly finished is remayed. The label for the next B side is a ready in position Skilled aperators turn out a record about every 48 seconds.

21. The record comes out of the pressing machine with rough edges, but except for that it is ready for music stores throughout the nation. RCA-Victor is continually experimenting with new materials for making records.

22. The record is held by two felt-covered plates and rotated. A girl holds a piece of emery cloth against its rim to smooth its edges. Next it is slipped into on envelope, ready for market.



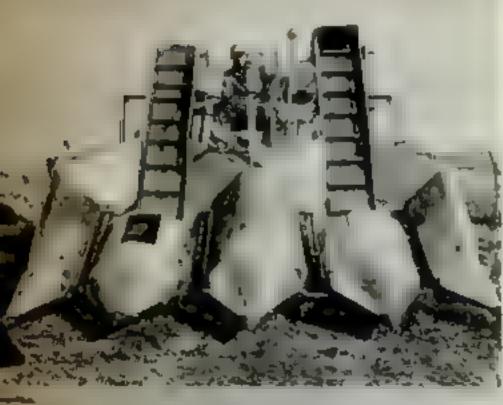






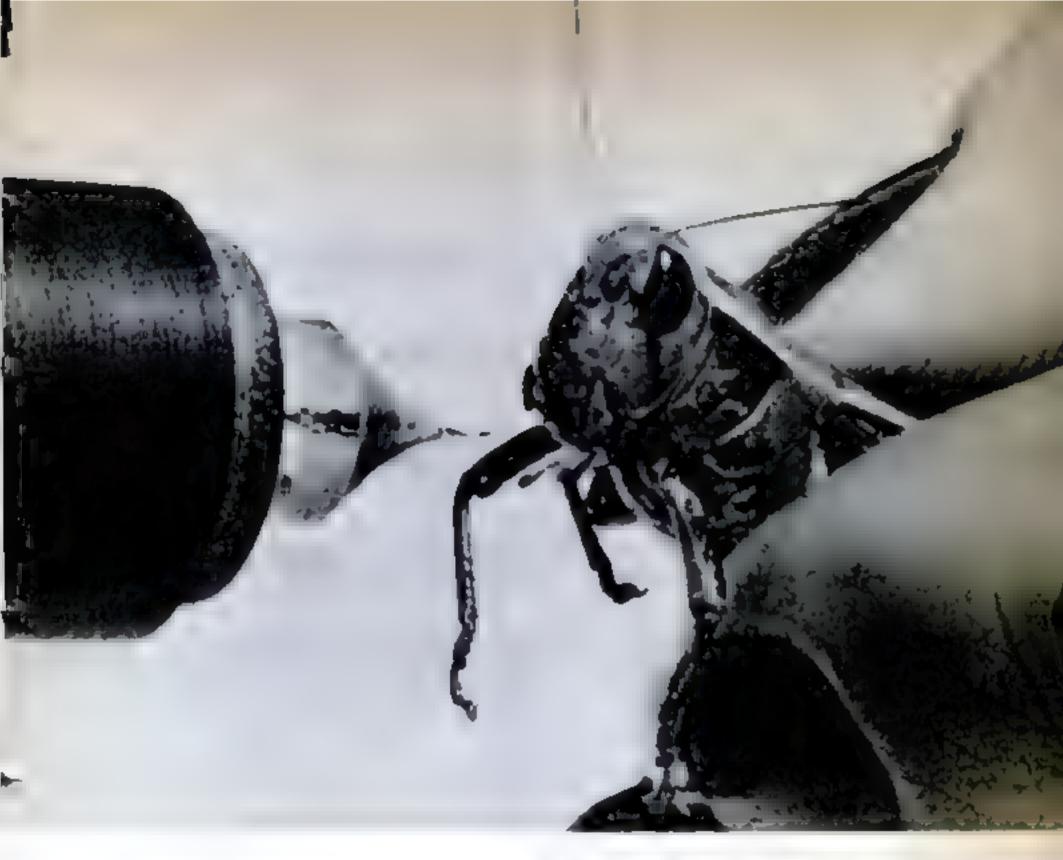
Rolling Laddo wheels for portability, the 64 Luminum "ladder" at right is propelled by turning the wheel, attached to a chain drive, at its top. The two shelves for holding materials are removable. The device was designed by Sam Dimon, of Los Angeles.

Four-Row Corn Picker. By combining a pair of two-row Oliver corn pickers into one unit in his El Paso, Ill., farm workshop, Lester Pfister devised the first four-row corn picker, shown below. He has since built three more. Pushed by a tractor and powered by a combine engine, the harvester's five claws, set on an angle in front, strip cobs from four rows at a time. Two belts then convey the cobs into a husker, which deposits them on another belt that runs to a trailing wagon. The picture at bottom of page shows the pickers at work. One machine accomplishes the work of 30 men.









Taking a Grasshopper's Temperature. When and where grasshop pers will feed is a multimillion-dollar question to harassed U.S. wheat farmers One answer recently offered by Montana State College enterno ogists Profs J K Pepper and E B Hast ags, is that it depends on the pears, body temperatures, the sunlight's intensity and the air's temperature help the investigators take grassh opers temperatures General Electric designed a deacase inermocouple 5 1000 and in day ameter It is shown above about to be inserted into a hopper. The data it supplies will be p the scientists ted farmers where and when to spread possened by

Muscles for a "Tin Can." Each of the twin main reduction gears at right will transmit 30 000 hp to drive the propellers of a 2 200-ton destroyed largest U S type. The gears built by Westinghouse perform the final step in solving the speed of the steam turbines spindles to the speed of the ships screws.



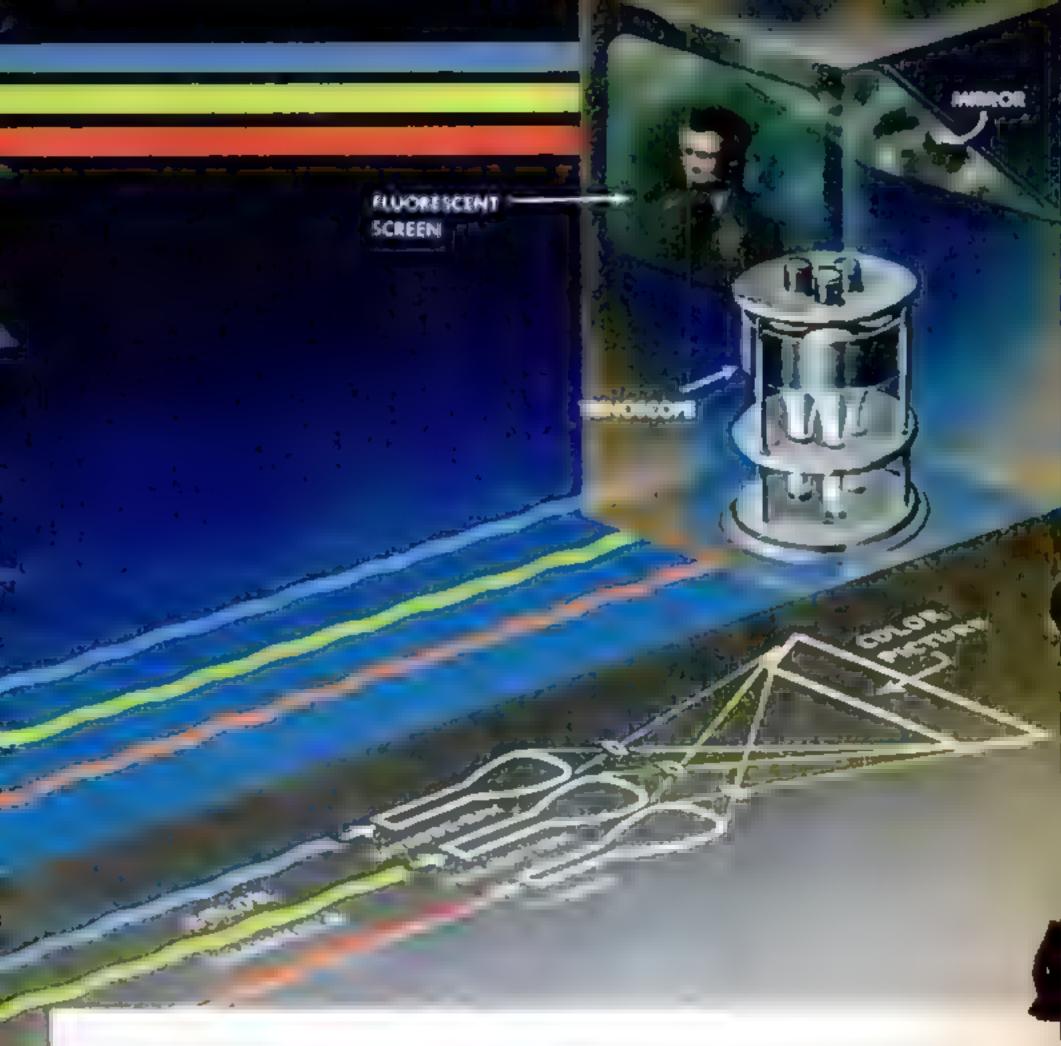
LIECTRONIC COLOR TELEVISION IS HERE

COLOR

COLOR 10 BREAK-UP UNIT

FILM SCANNING JUNIT JULIGHT SOURCE

IN SCIENCE



A LL-ELECTRONIC color television, which RCA engineers have achieved in a form that does not make black-and-white equipment obsolete, is a complete departure from the mechanical color transmissions of recent years. Mirrors and photoelectric cells replace moving parts.

In a recent demonstration at Princeton, N. J., pictures were broadcast with a new color-slide camera. Its developers plan laboratory transmission of live-action studio scenes by mid-1947, outdoor action scenes late in 1947, theater-size pictures in 1948.

The electronic system's mirrors and tubes split a beam of light into red, blue, and green images. Three kinescopes in the receiver pick up the separate images simul-

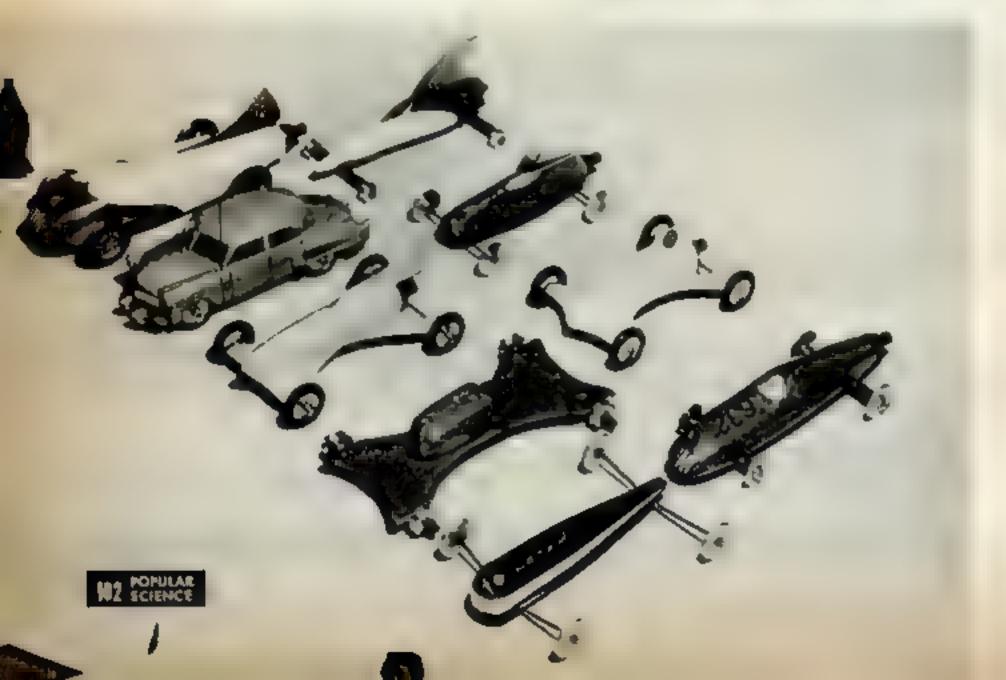
taneously—in contrast to mechanical systems in which a rotating filter transmits the three colors one at a time—and project a merged, flickerless picture.

Color television requires much higher frequencies than black-and-white work because a wider band must be used. The operating standards, however, such as the scanning rate, humber of lines, and rate of picture repetition (30 per second), are the same as in commercial television. So a frequency converter would suffice to equipany black-and-white receiver to handle color broadcasts in black and white. Thus the advent of commercial color television—still some years away by RCA estimates need not make present sets obsolete.



They re off! The equirrel size vehicles hit speeds around 50 mph. over a 240-foot straightoway in an aisle of the sprawling Santa Monica plant. They are timed to an accuracy of 1/40 second

The cars (below) are of hollow balsa weigh from 1/8 nunce to 4/4 ounces. Those under 21/2 aunces are in the light class—those above in the heavy. They're guided by strings stopped by a curton





Each machine is weighed in before a race. This one balances a one-ounce weight. The racer has thin aluminum wheels that turn on steel bushings



A racer's power plant—a cartridge for a sada water siphon—is inserted into a hole drilled into its tail. This 21/2-cance baby rolls on hard rubber tires

on FIZZ

An owner (below) awaits the "ga" signal to shoot his car down the track by puncturing its carbon-

Douglas Aircraft engineers enliven noon hour by racing tiny cars jet-driven by CO,

dioxide "engine" with a needle-tipped plunger. Size of puncture in cartridge depends on car's weight



Scraw eyes, bent wire, and cotter keys with an arm removed form snap-on guides for the string that keeps the racers in line. Tool experts make the cors. The Finish! A black job is about to crash the rolled curtain that stops cars. Racers sometimes swerve off course and smosh to pieces against the wall







PSM photos by HUBERT LUCKETT

Gloss model at left is alkylation unit that turns waste gases into aviation gasoline. It was made by Margiotta and Graf, the glass blowers shown at work below. Yellow vessel of units upper left prepares acid catalyst which feeds into red reaction vat. Hydrocarbon gases enter through red tube at upper right and are liquefied in yellow condenser at right. Motor atop reaction vot turns paddle to agitate catalyst and condensed gases. Tube with green soil at right of motor returns unreacted gases to vat.



By J. S. QUALEY

OST of our giant oil refineries have glass skeletons in their closets. Before they spill one drop of gasoline, lubricants or other by-products of crude into the pipe lines or the stomachs of water, rail and highway tankers, their efficiency at squeezing out every cubic centimeter of value has been planned and proved in glass models

sitting atop stone tables in engineering laboratories.

Actual creators of these refineries are the glass constructionists who fashion the prototypes. Typical of scientific glass blowers are three men in the laboratory of the M W Kellogg Company plant in Jersey City, N J.—master glass constructionist

T. A. Graf, and his staff of two, Robert Connelly and James Margiotta.

These three apply their craftsmanship and knowledge to creating increasingly improved methods of processing crude oil. The diminishing oil reserves and the changing nature of these resources make the work of the glass technicians of world economic significance.

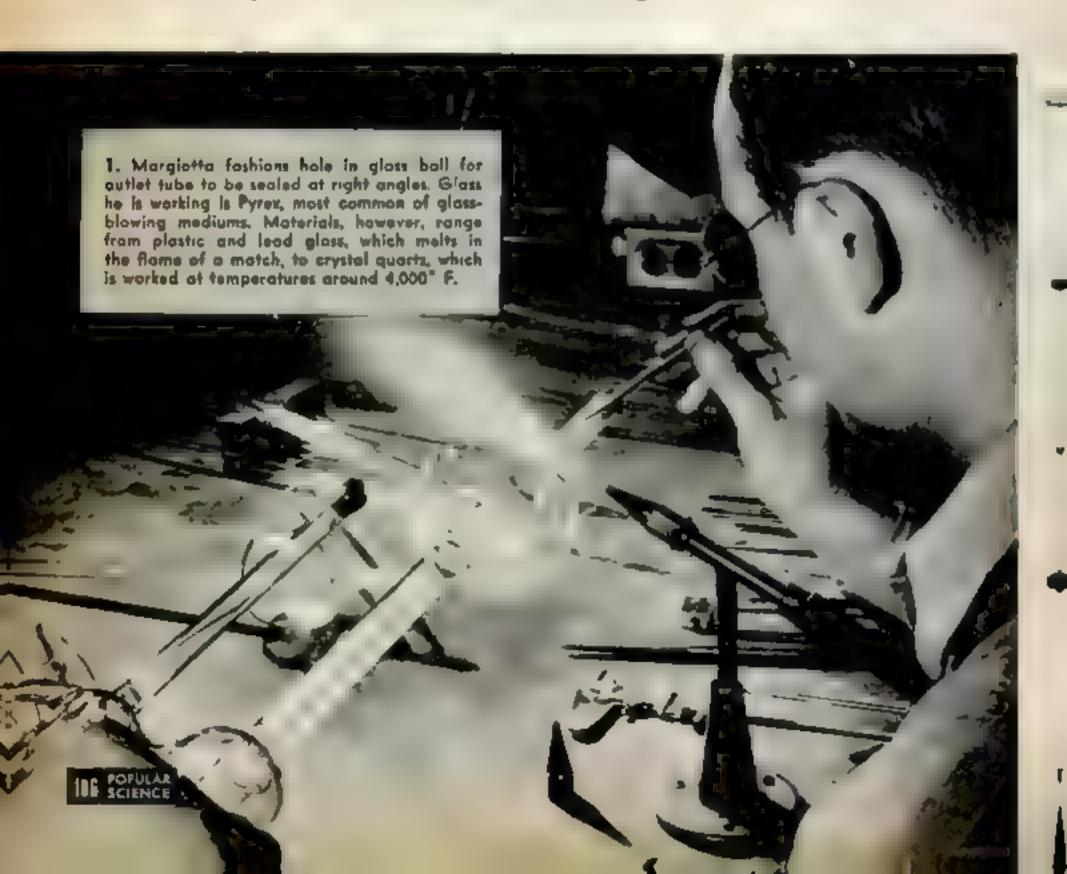
Kellogg's is an engineering construction firm specializing in perfecting refinery methods to meet the ever-arising problems of individual companies and newly discovered oil fields. Its laboratories and shops in Jersey City provide all the services required by the oil industry. One example of the projects designed and constructed by Kellogg's in the famous catalytic cracking plant at Aruba, in the Netherlands West Indies. The Aruba "cat-cracker" played a historic part in supplying the Allied needs for all types of petroleum fuel in World War II, and is still producing in heavy quantities.

To do the creative and precision work required at Kellogg's, glass constructionlats need a variety of talents approaching those of the many-sided Leonardo da Vinci. They must not only be able to turn glass into the most intricate and exact shapes; they must be practical physicists, chemists and engineers as well

As often as not, glass blowers fashion working glass models for new petroleum processes without benefit of blueprints or sketches. In such cases, an engineer explains the problem to be met, and how he thinks the desired ends may be attained. Then the glass constructionists go to work They blow the parts they figure are needed for the type of unit that will be most efficient in handling the particular kind of product they want to process.

Not always, however, do the glass workers design the apparatus for new processes "out of their heads." On some jobs they work from engineering drawings. But even then they must have a knowledge of all phases of the oil-refining field—of furnaces, reactors, regenerators, fractionators, and so on

When all the glass parts needed have been turned, they are assembled into a model of the unit the glass craftsmen and the engineers had in mind. Then actual tests, using the crude oil to be tested, are



run through the assembled laboratory unit-

These glass mockups are not fashioned to scale, but they do handle the ingredients to be processed in their real proportions. Once the models are operating as the engineers believe they should, they are copied in metal in a pilot plant. Then, through the pilot plant, larger amounts of petroleum are tested. Engineers watch the tests and make improvements and, finally, when the pilot works at utmost efficiency, it becomes the model from which Kellogg's will build commercial plants in the areas where they are needed.

This method, combining theory and experiment, has revolutionized oil refining in the last 10 years. Besides saving millions of dollars in petroleum products that might otherwise have been dissipated, the models and the pilot plants have supplied valuable data for the oil industry.

How long does it take to become a glass blower proficient enough for the tasks required in such a laboratory? "If you start young enough," Graf says, "and are suited to the work, you should be good about the time you're 40."

Graf started at 14 He got his training in

Europe. He didn't choose his career, but was assigned to it by the government in the person of his school teacher. His apprenticeship lasted four years—seven hours a day doing manual work, three hours a day studying engineering, chemistry and physics. After that he had to serve a two-year "internship" with one company. When a course like his was finished, a European glass blower was considered about ready to earn his salt in the scientific field. If he wanted to go into the commercial field, however, he could make fair money as a blower of knickknacks.

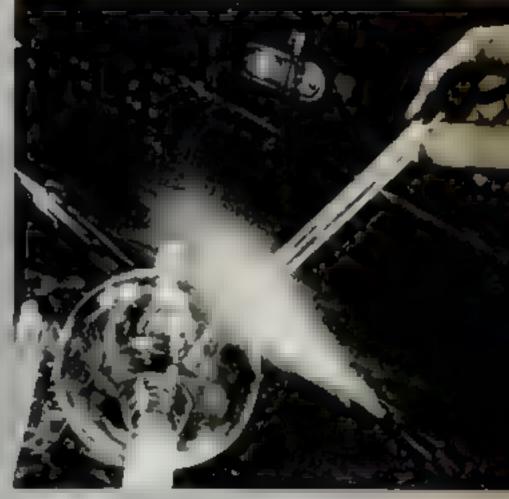
It's easier in the United States, because there is no set period of apprenticeship. Most American-developed glass turners learn their profession, as young Margiotta did, in laboratories such as Kellogg's, under masters such as Graf

Connelly is a graduate of a third school of glass blowing—the family. Orphaned as a child, he was taken into the home of an uncle, a glass blower, who started Connelly's tutelage at the age of 12. Before joining Kellogg's staff, Connelly did precision fabricating for RCA.

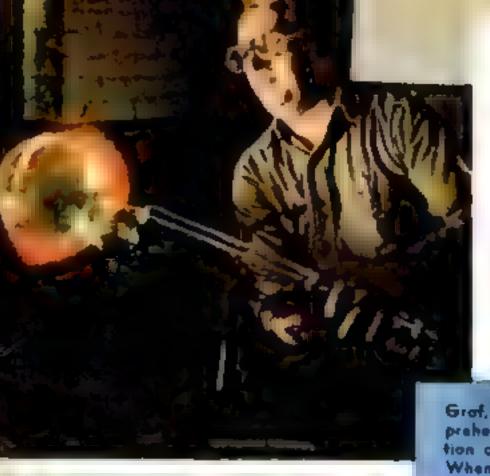
Margiotta is getting his scientific back-



2. Continuing on his project, Margiotta blows into a tube to create the visible bulge, which is just about the size he wants it. When it is exactly right, he has to take it out of the flame, let it coal, notch it with a file, and crack it smartly across the edge of his bench to divide it in the middle of the protuberance. For him, this operation is one of the simple ones.



3. Here Margiotta fuses the spread end of the upper half of the tube into the hale he prepared in the bulb. Next, the apparatus is placed in a furnace and annealed by heat intensified 100° F. every hour for 12 hours. Then it is cooled at the same rate for the same length of time to give it integrated strength.



ground at Columbia University at night, studying for a B.S. degree. As a GI, he supervised a large glass-blowing staff at the Oak Ridge atomic project during the war. Incidentally, long before the Oak Ridge plant was functioning, glass blowers had fashioned models of the apparatus that was to open so large a door to the future.

In addition to a rigorous education and wide knowledge, a glass constructionist must have the right physique—true eye and a sure hand for delicate work, and stout muscles for turning out cumbersome

Graf, upper left, turns bulb of double-lacket in fire, preheating it preparatory to making a hole for addition of tube. At left below, he seals hale in bubble. When inlet tube has been fused on, the project will be a prototype of a refinery's stabilizing calumn.



To appreciate the muscles and stamina needed in the working of glass, it must be remembered that once a job is "in the fire" there can be no letup in the turning, pulling, twisting and blowing until the piece is finished—even if it takes 10 hours. A few seconds out of the fire can ruin a painstaking, coatly job.

And the right temperament is also necessary, for they do work that would sap the patience of an engraver on the heads of pins.

A true eye is as essential to an engineering laboratory glass worker as exact pitch
is to a concert singer. Much of the work
at Kellogg's precludes the use of measuring
aids. The spiral in a glass coil or an elbow
of tubing cannot be measured while the
worker keeps weaving it in and out of his
flame. The eye carries the entire responsibility.

To split a hair, the class of work done by Kellogg's staff is not properly called glass blowing. Rather, it is glass constructing—or fashioning. Only occasionally is it necessary for the technicians to puff into a glass or rubber tube. Mostly they turn, pull and twist their mediums into shape.

Judging from past performances, even more intricate glass skeletons for greater, more economical petroleum and chemical refineries of the future are certain to come out of the heads and the flames of the laboratory glass technicians.



Connelly builds a tube out of crystal quarts, the most grueling kind of work in the business. Crystal quarts is the bardest, purest medium worked by the glass technicions. Connelly makes his specimen from granulated quarts, which is first washed in sulpheric acid and distilled water and is then picked up from a source underneath his burner.

THRUST. Like a Fourth of July skyrocket, thrustdriven devices such as V-2s and the Wac Corporal depend upon the energy of their feel charge and need no air to sustain them, Rocket speeds range

up to 3,500 m.p.h. and this form of power may give man his first taste of super-sonic Right



Three Routes to SUPERSONIC FLICAT

ENGINEERS, striving to build a flying machine that will carry human beings faster than the speed of sound, have only three modes of flight with which to do it. These illustrations, used by Douglas engineers to explain the basic theories of flight, portray the principles upon which supersonic aviation must depend—until science thinks up something new



WINGS. Airborne flight, represented in its timplest form by a child's paper airpone, utilizes aerodynamic forces, created by the action of air upon a wing passing through it, to provide lift Limited partly by the very wings that sustain them man-carrying airborne devices have as yet only nibbled at the bottom edge of the sanic barrier

MOMENTUM. A connon shell, like a pebble from a bay's slingshot, illustrates momentum-borne flight, in which an object is set in motion by a force greater than its own inertia and then coasts. Momentum plays a part even in the flight of thrust-borne devices after their fuel is exhausted but true momentum-borne missiles carry no fue and have no continuing propulsion.

Id like to see them make

Cortoons by SYD LAND! Everybody has his own pot idea of some gadget he would like to see in peneral use. What is YOURS? Papular Science Monthly will pay five deliars for every such suggestion that its aditors ducide to publish.



Cataup Tamer. Not too much. not too little, with this catsup regulator says Bill Hopewell, of Cincinnati.



Fireside Lie Detector. It would put an end to tall tales around the house, declares Mrs. R. L. Clark, of San Jose, Calif.



Back-seat Ejector. The automotive device above is the interesting brain child of David E. Mann, Jr. of Needham, Mass.



Thront Saver. Eye-and-mouth masks for nonsmoking movie-goers are suggested by William Lohorco, of Brooklyn N. Y.



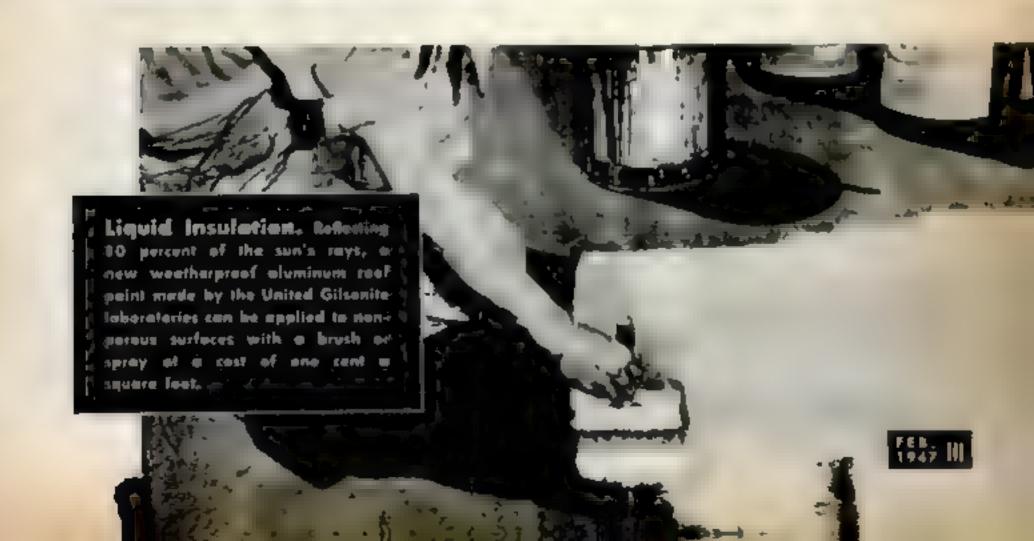
Squawking Purse. One that cries out if owner's grip is released appeals to Mrs. Ethel T Cearley, of Compton, Calif

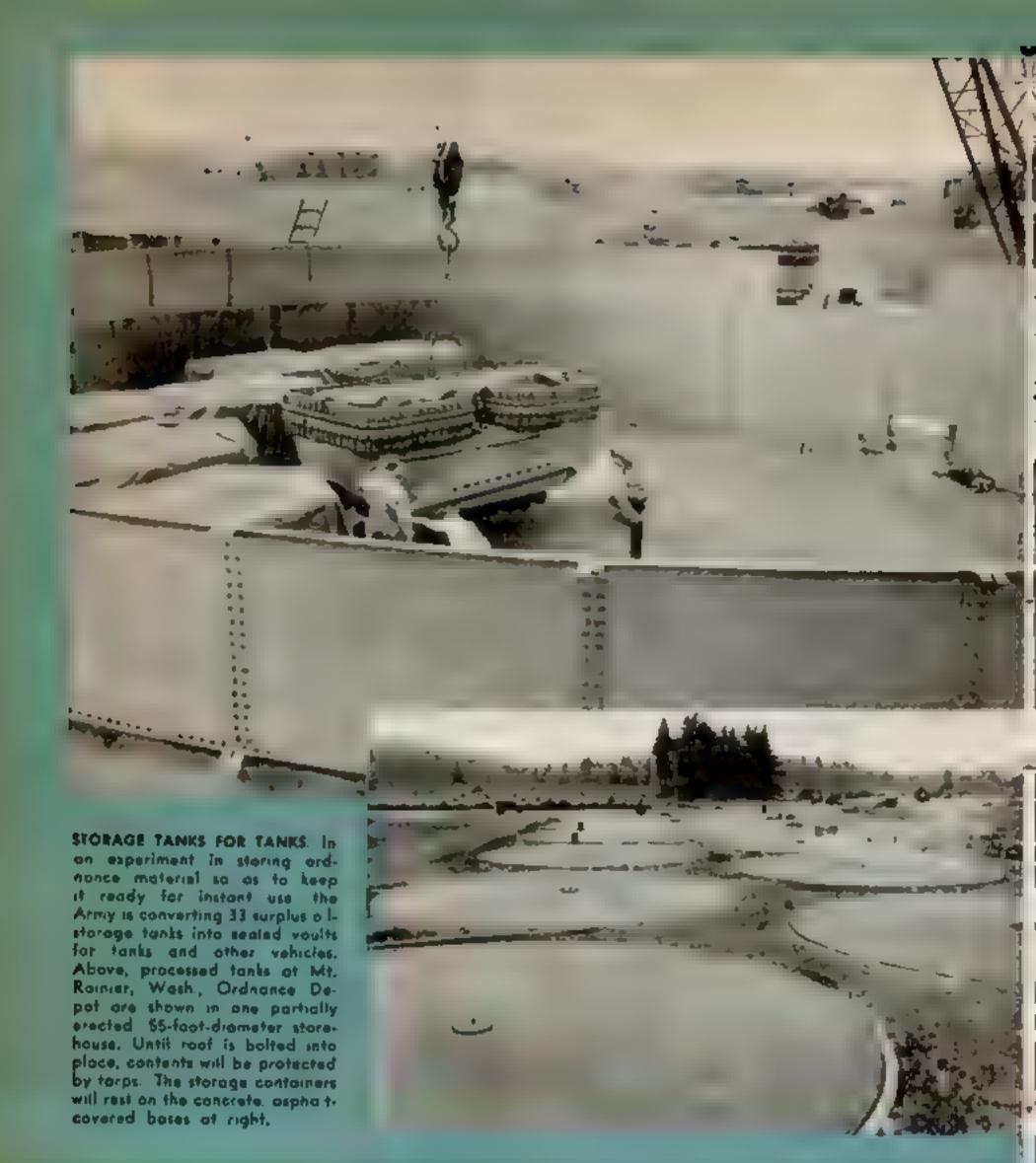


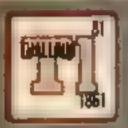
Shake-up Wake-up. An awakening arm, not an alarm, is proposed by Sergio Horacio Paredes, of Brownsville, Texas.



BEFORE ice floca hampered navigation ship owners had a chance to watch coveted radar at work on the Great Laker. The ore boat A, H. Ferbert tested marine radar equipment on a six-day run. Outfitted with a Radiomarine Corp wave guide and reflector antenna (upper left) and an indicator unit (above), the Ferbert eaught pictures that enabled Capt, Frank Day n port to distinguish between passenger ships and ore carriers at distances up to 2% m less At left is one of the radar "maps. The Ferbert is the spot in the exact center, while the elongated white images are the banks of the St Marys River between Lakes Superior and Huron. The dots about and astern of the ship are buoys.







CORRECTION

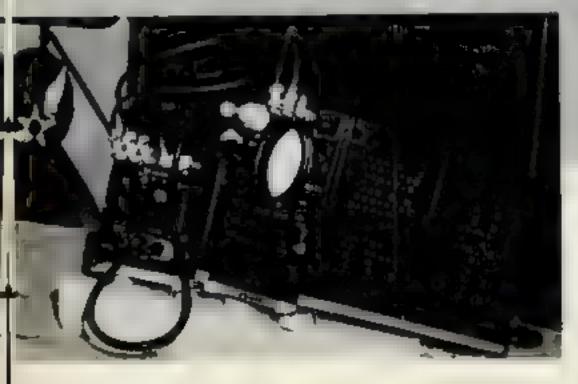
In the list of elements on pages 104-105 of the November 1946 issue of Popular Science Monthly, the chemical symbol for thalium, the Eist element, appeared as Ti Instead of TI. For those readers who built the Courtines "castle of elements," we after here a corrected black of proper size and color, which they may cut out and paste over the original black.



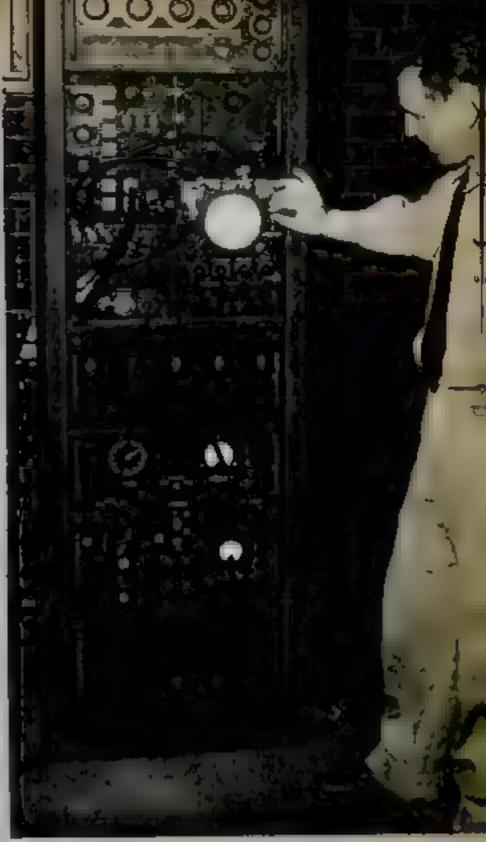


Dry-Land Navigation Training.

Make-believe flights and voyages now eliminate risk while Navy students learn to use Loran, short for "long-range navigation" by radio. A transmitter, right, emits signals which are picked up by a movable "crab," representing a plane or ship, on the chart table above. Because radio waves travel too fast to be timed accurately on this miniature scale, they are replaced by sound waves,



Safest Document Vault. Without wetting or blurring papers, overhead nozzles will smother flames almost instantly if fire threatens priceless records, signatures, and agreements at United Nations headquarters. Lake Success, N. Y. Designed by Walter Kidde and Company, New York, the system releases a ton of carbon dioxide, automatically shuts doors and stops ventilators.



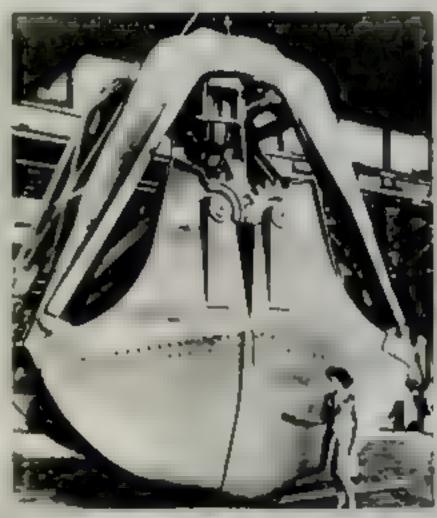
pitched above range of the ear but made audible by the special receiver at left. Listening in, the learner plots his position and then compares it with that of the "crab" to find his score.

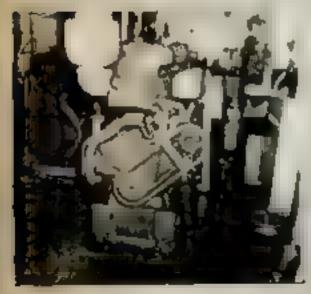




Road-and-Railer. Fitted for roads or rails, the postwar Evans Auto-Railer is guided on tracks by flanged, steel pilot wheels. Fifty percent of the load bearing and all driving and braking are done by the regular wheels, equipped with special-tread rubber tires having 34 times the traction of steel railroad wheels. Pilot wheels lift hydraulically for road use

Super Coal-Reaver. If the clamshell bucket at the right were unloaded just once in the basement of the average American home, it would deposit enough coal to last two years. Built by Blaw-Knox Co. to speed up stock-piling from lake boats, it operates on a bridge-type crane and holds 17½ tons of coal—23 cubic yards.



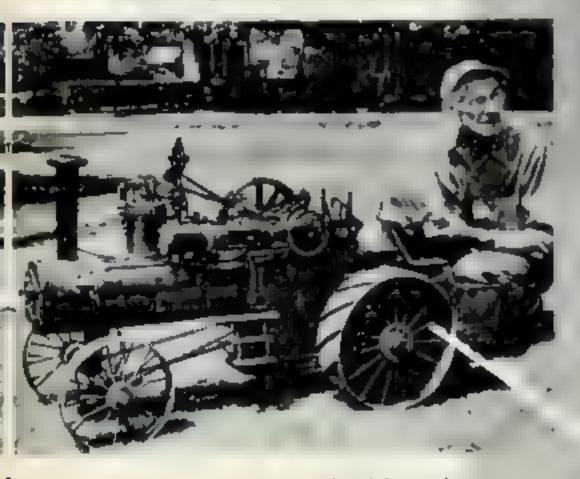


At on a Freighter. All auxiliary devices except cargo winches aboard the newly launched motorship Angelo Hinguns, of New Orleans, (below) are operated by alternating current—a novelty on a argo ship. Three 60-1 w. generators are driven by three 120-hp. Hercules Diesel engines, one of which is shown at left. The complete plant generates 440-volt, 2-phase, 60-cycle current. Winches operate on AC-DC motor generator sets.





Van Baren tinkers with madel on his lawn. Tractor weighs 260 pounds; thresher, 240.



Tractor even has a tiny shovel for coal. Below are the thresher's chopping blades.

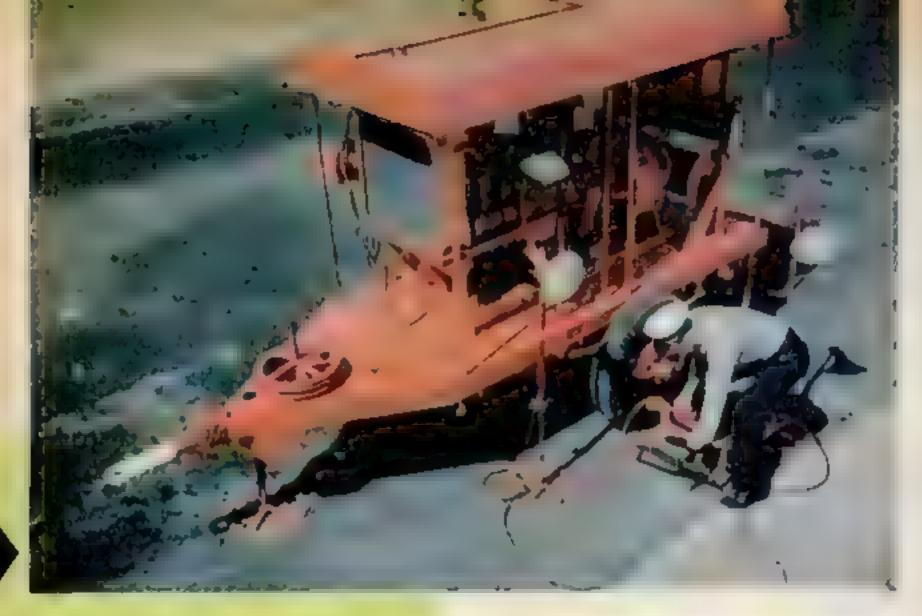
Small Way

RECALLING a vanished era of farming, John J. Van Baren, of Newton, Iowa, has reproduced an old-fashioned steam tractor, its water wagon, and a threshing machine. Complete to the tiniest detail, they do everything the originals did—but they are exactly one-quarter as big. Lacking engineering plans, Van Baren had to hunt down examples of the outmoded equipment for his measurements. With the exception of belts, chains, and a steam gauge, the models were made by hand. Their creation in spare time required eight years.

Miniature wheels change direction and angle of thresher's Packing pipe. It discharges straw.







Floodlight Truck for Fires. To provide illumination at isolated night fires or sirplane crashes, the firefighting staff of the Douglas Aircraft plant at Ed Segundo, Calif., developed the auxiliary truck shown above. Mounting 10 floodlights of 200 watts each, it has a detachable fuse box with 18 plug outlets. The electrical equipment is powered by a 100-horsepower gasoline engine, and the truck itself is designed to be towed by any of the plant's fire engines.

Firevete. Another specialized piece of equipment used by Dougias at El Segundo is this three-wheel motorcycle, which provides extreme mobility and permits close-quarter firefighting in narrow aisles or other confined places anywhere in the sprawling plant. It has been rebuilt to carry chemical equipment over the rear wheels, where separate recesses contain two 30-pound Du-gas extinguishers and four carbon-dioxide extinguishers—two 15-pounders and two two-pounders.

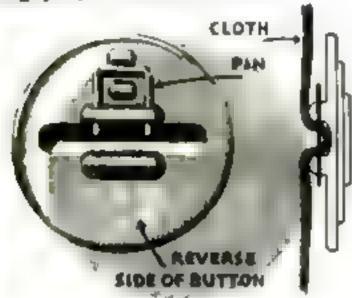




Stress by the Ton. While hydraulic jacks thrust upward and water tanks in the fuselage exert a downward load of 15 tons, electrical gauges measure the stresses set up in Constitution's nose gear.

NEW IDEAS from the INVENTORS

Threadless Buttom. Cloth is folded into a groove in the back of the button diagrammed below, and the button is fastened to the material by a staple. It was invented by E. W. Biegajski, of Buffalo, N. Y.



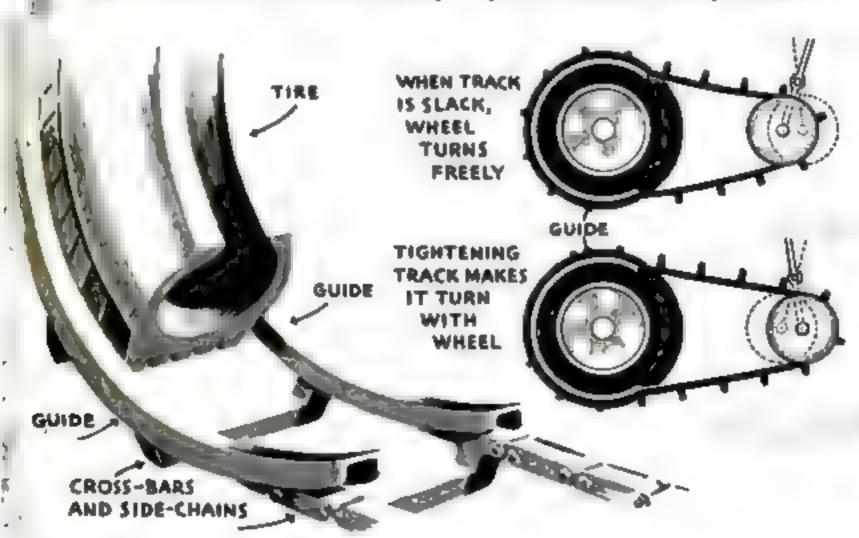
Pocket Lock. A zipper seal that makes the back pockets of trousers theftproof is pictured above. The antipickpocket guard was invented by Leopold Schonthal, of New York City. When locked, the zipper is closed all the way, and the chain, which is attached to the zipper clasp, draws taut and is anchored to a snap button inside a side pocket, so that it cannot be unfastened without arousing the wearer.

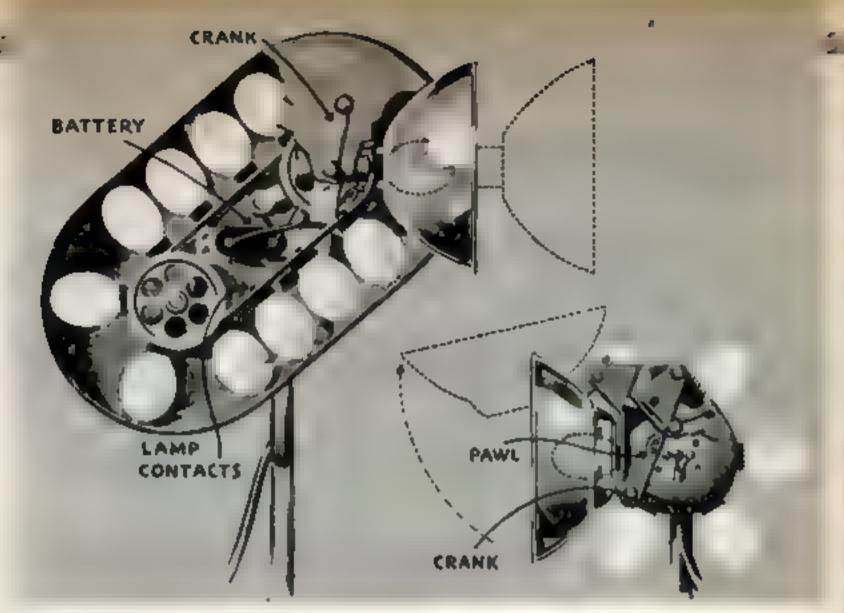
SNAP

BUT-

Nonskid System. For traction on slippery surfaces, the tire "chain," or track, diagrammed below can be put into action by merely pulling a lever. When the track is not in use, spring-loaded guides mounted on the axle hold it away from the tire, which then is free to run on the roadway

through a gap left in the track's crossbars. Pulling the lever moves an idler pulley that tightens the track's guides against the wheel. The upper right-hand drawing shows the track in its free-turning position, tire resting on the ground; drawing below it, wheel as it turns the track. It was invented by C. W. Hunter, of Bryn Mawr, Pa.



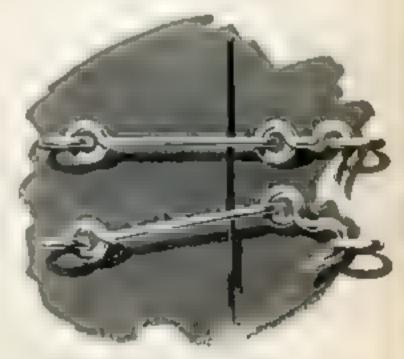


Repeating Flash Systems. Timesavers for photographers are the two lamps above, in which manually operated cranks replace spent bulbs with new ones, moving the reflectors out of the way as they do so. Once the fresh bulbs are in place, the reflectors return to position. The

top lamp was invented by E. B. Nobel and A. W. Seitz, the lower one by John J. Malloy. Both devices use a series of bulbs with bayonet-type bases, and their discharge switches can be operated either by hand or by synchronizing apparatus.

Warning Light. An automatic warning of decreasing speed is provided by a light for cars and trucks devised by the Automobile Safety Light Co., of Chicago The light, shown on the back of a car below, gets its current from a rear spark plug. When the engine is running fast, the light burns a steady, bright red. As speed is cut it starts to flash a warning that the car is slowing down.





Pickproof Laten. Prowlers will not find the new door latch above, invented by A. M. Chester, of Austin. Tex., as easy pickings as the old type. The new latch has a jointed shaft which buckles and buries its hook deeper into the eye when the shaft is lifted from outside the door



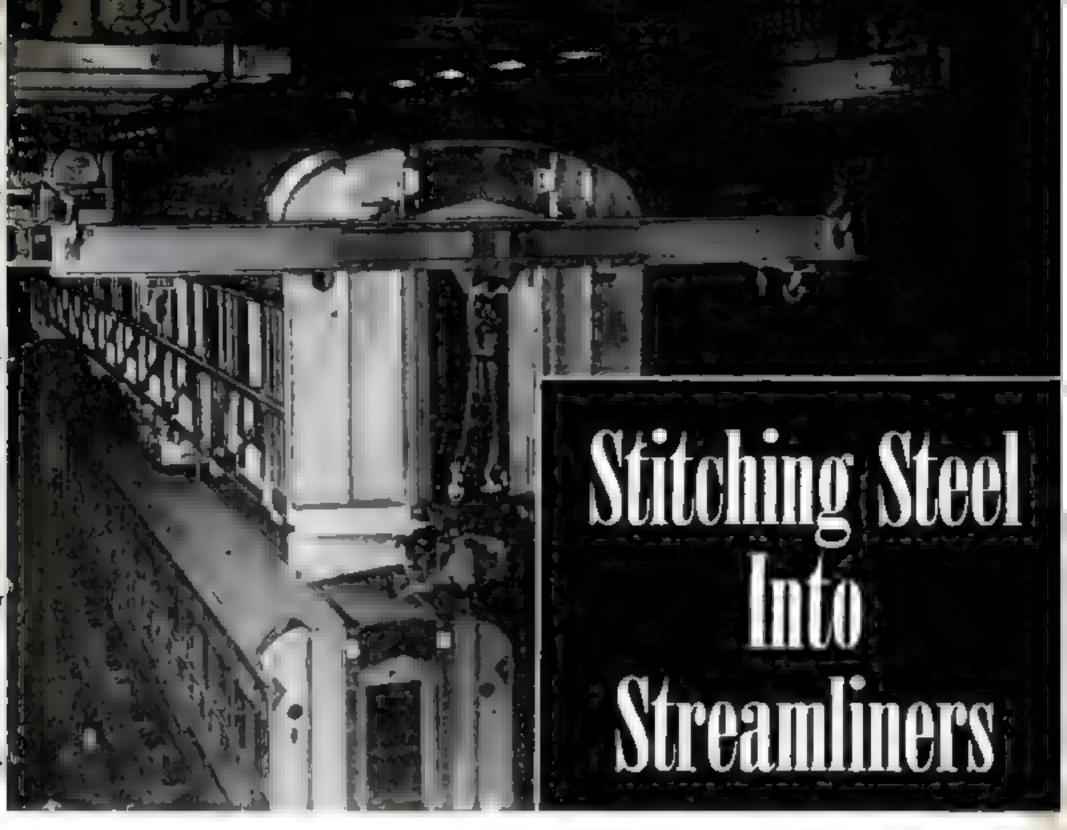
DUELING PISTOL. No project for clothespin whittiers, this accurate model of an old German weapon will give the painstaking craftsman a fine chance to show his stuff Finishing wood to resemble metal is a crucial part of the job. You'll find plans and suggestions for both carving and finishing in the article beginning on page 154.

TOY-BLOCK LAMP. A bright spot in a youngster's room, this lamp captures the play spirit. It makes use of built-up wooden blocks, standard electrical fittings, and a shade covered with shelf paper. Details of construction are given on page 160.





SURREALISM IN THE BOUDOIR, Costume rings can be kept on this plastic hand for the dressing table, which gives that slightly bizarre touch dear to decorators. As described on page 160, it's cut and shaped from a single sheet of clear plastic and then cemented to a small, frosted-edge base piece that holds it upright.



By MORTON C. WALLING

As YOU stand on a catwalk high above the plant you can scarcely see where it ends, dim in the distance, five city blocks away. The workmen dwindle to mere specks, the gigantic U-shaped welders become tiny tweezers. Toward you stretch three long, silver caterpillars: assembly lines. Here and there comes a flicker of blue flame from an arc welder, reflected and reflected again from shining stainless steel. Occasionally there is a rumbling medley of thumps from shot welders; otherwise there is only a low hum from the thousands of workmen and machines.

Here is modern technology in action—the assembly-line system the auto industry made famous. But as the great cranes swoop down along the line and the silvery bodies roll nearer and nearer you can see they are too

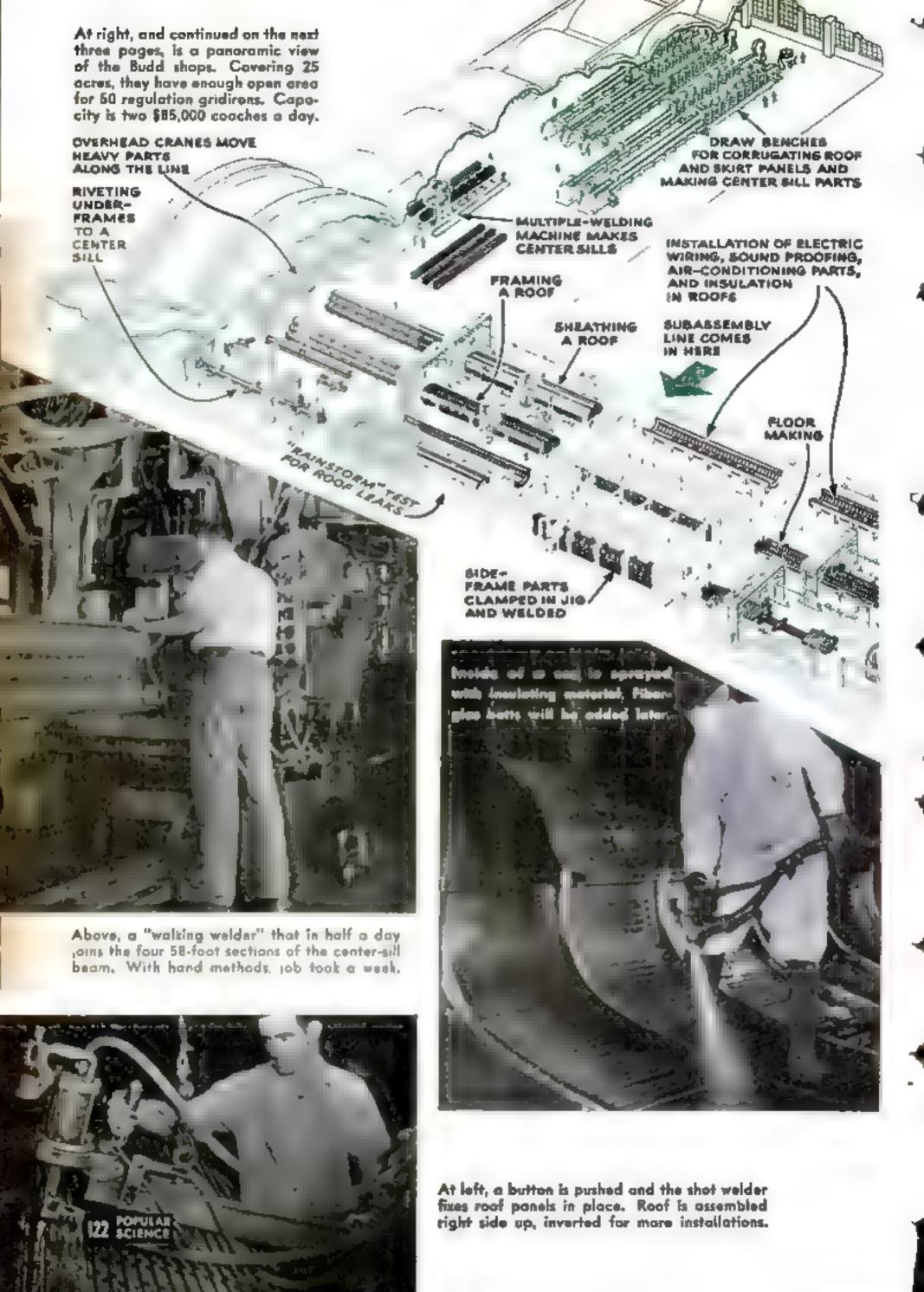
Budd's new assembly line rolls out cars like cans.

shiny for automobiles—and too, big. Each is as long as half a dozen motor cars—a stainless steel railway coach

For this is the plant of the Budd Company, where the high-speed step-by-step assembly techniques they have long used in making all-steel auto bodies are applied to railway cars. And the result will be a new standard of comfort in railway travel, at a reasonable cost. By the application of Detroit methods to Philadelphia, what starts out as stacked rolls of stainless steel, varying from 1/10 to 1 4 inch in thickness, emerges a short time later as a finished railroad car, ready to be towed out and put behind a locomotive. In between are some quarter-million shot welds, 200 rivets—and some highly intelligent engineering.

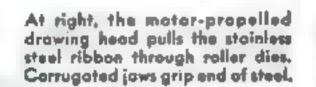
The first stainless steel train, the Chi-

STORY CONTINUED ON PAGE 126, FOLLOWING FOUR PAGES OF PICTURES





Above, the drawing bench puts wrinkles in stainless steel roof and side panels. A similar bench forms sections that make center sill, or car backbone.



PLUMBING, HEATING, ELECTRIC, AND BRAKING EQUIPMENT IS ATTACHED TO INVERTED PLOORS

FLOOR
MOUNTED ON
HIGH TRUCKS,
SIDE FRAMES AND
ENDS ATTACHED

Drawings by STEWART ROUSE



INSTALLATION OF SHEATHING PLATES AROUND WINDOWS,

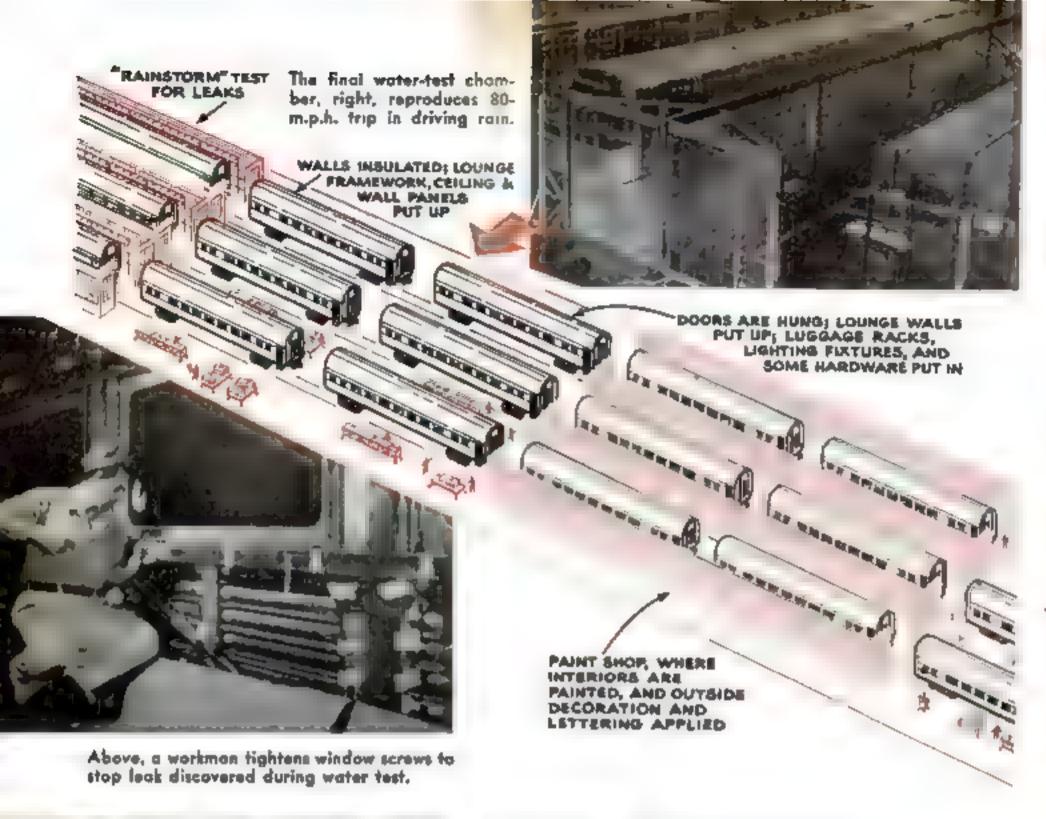
AND WINDOW GLASS

At left, underframe is upside down for installation of auxiliary equipment such as air brakes, heaters, plumbing. Arc welding does the job.

THE REAL PROPERTY OF THE PARTY OF THE PARTY

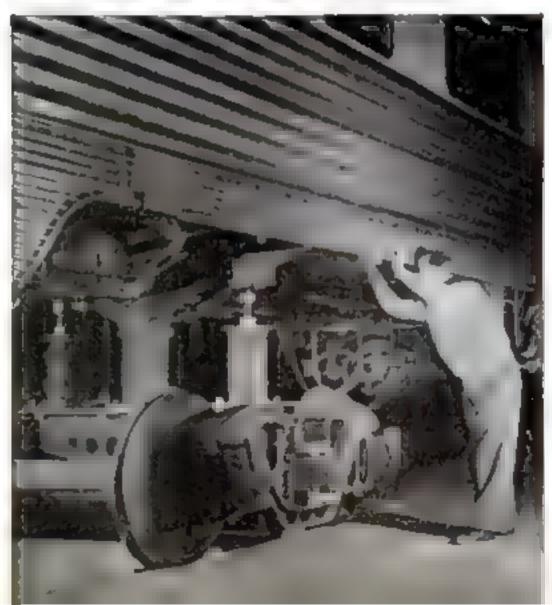
Roller dies above are the super-taugh wringers that actually wrinkle the metal. Part of the drawing bench, each costs as much as \$5,000.

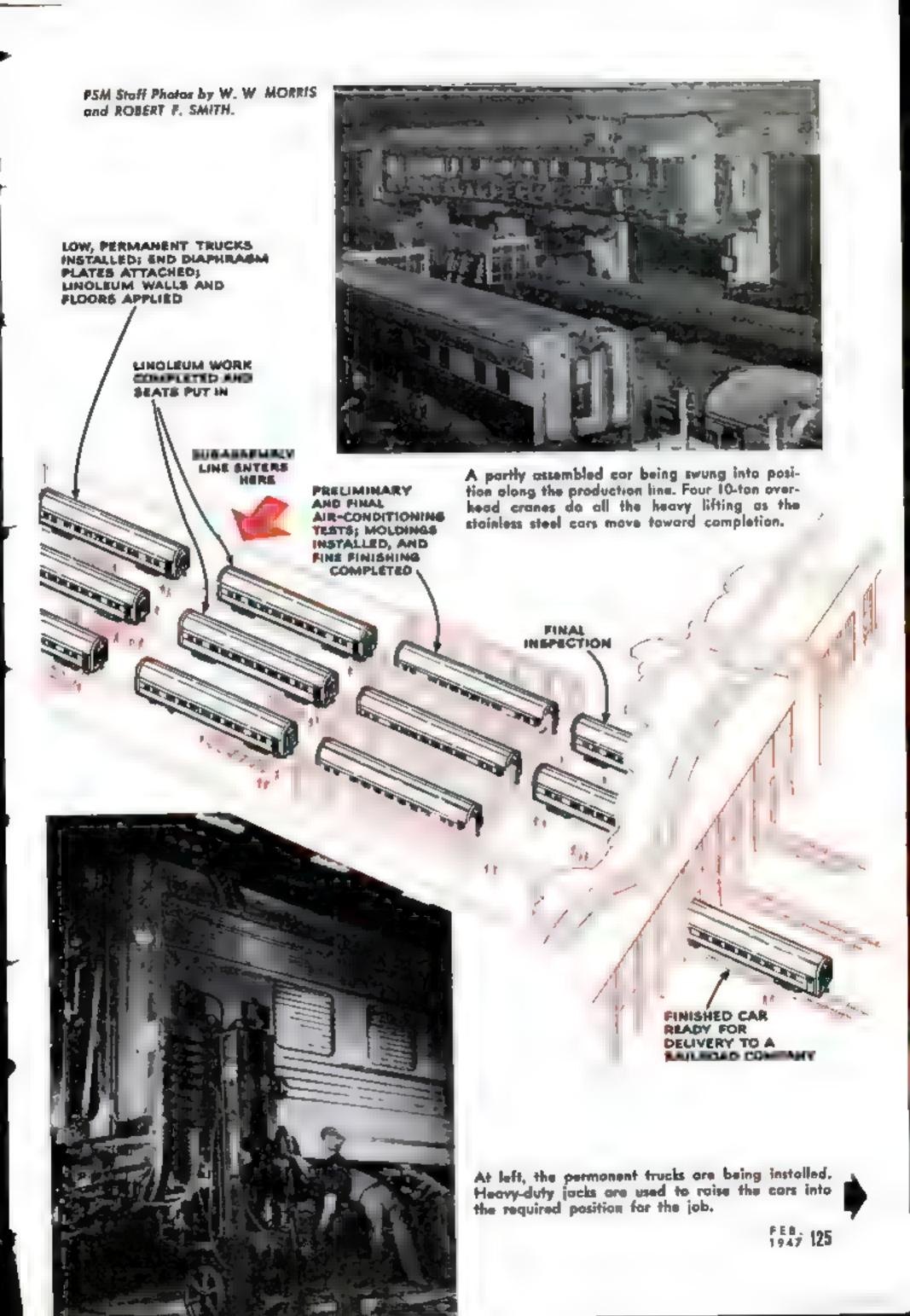




At left, a shot welder joins a side frame to an underframe at the first main assembly position, where skeleton car is formed.

Below, assembled car is set on temporary raised trucks before side paneling and fluting are applied.





cago, Burlington, and Quincy's "Pioneer Zephyr," was built by Budd in 1934. Up until the beginning of the war, when all railroad-car production stopped, Budd had built and sold 47 complete trains to 14 railroads. So the firm is an old hand at this big job.

Budd-built railroad cars—except for their trucks, end underframes, and miscellaneous decorations and fittings—are made entirely of welded stainless steel. By a method of electrical stitching, called "shot welding," strips and sheets of stainless steel literally are "sewed" together with rows of uniform

spot welds,

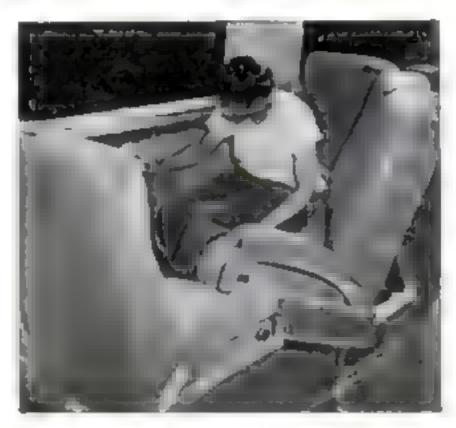
Shot welding, a Budd development first used in 1931 to produce the first stainless steel airplane, is a form of electrical-resistance welding. Time and the current, and therefore the heat, are automatically controlled. The result, according to Budd engineers, is a strong weld that changes none of the characteristics of the surrounding metal, and that can be made just about as rapidly as the operator can move his U-shaped welding tool. In the course of the production of a railroad car, more than a dozen different types of shot welders are used, ranging in size from a few feet in length to fifteen.

This combination of strong welds and stainless steel gives Budd cars a heavyweight's strength with a welterweight's body. In a recent test, Budd research engineers placed a standard 118,000-pound stainless steel coach between the jaws of one of the world's most powerful compression-testing machines. The project was to squeeze the car along its main fore-and-aft axis until it buckled in much the way that it might in a head-on wreck. The "big squeeze" was applied slowly so the stresses and strains could be studied. Finally, when the first signs of buckling appeared, the testing machine's gauge showed a pressure of 1,865,000 pounds—more than three times the 500,000pound standard for safety required by the Association of American Railroads¹

Part of this strength is built into the cars at the beginning of the assembly line where, at the No. I feeder, the stainless steel for the roof and side panels is corrugated. This work is done by a battery of large draw benches similar to the benches used in drawing wire except that the material is flat instead of round. The ribbon of flat stainless steel is pulled through a series of powerful roller dies until just the right corrugation is obtained to provide maximum stiffness.

When a desired length has been drawn, the corrugated sheet is cut off with a toothless Carborundum saw, called a radiac. Except for the cutting operation, the drawing is a continuous process. When one roll of stainless steel is used up, the end of a new roll is welded to it. A novel rolling welder is used for this operation. A metal welding wheel is simply rolled across the joint and the weld is made.

The center sill or main under backbone of the car consists of four X-inch formed sections of stanless steel. After being drawn to shape, the sections are moved to an assembly jig where, once they are clamped firmly in place, a motor-driven "walking welder" resembling an animated drill press moves along the assembly and automatically makes the more than 3,000 individual shot



Last step before final inspection is cleaning and polishing the completed car. Note the easily turned lounge seats in this coach.

welds that bond the section into a strong 58-foot-long beam

Once the roof and side panels and the center sill are ready, the main assembly job begins. The center sill is placed in still another jig where a "silent riveter"—a long-size pair of hydraubcally operated jaws squeezes rivets into place easily and noise-lessly with its 50-ton pressure to fasten the end underframes to the ends of the center sill. This complete underframe unit is then moved by overhead crane down the line where floor beams and floor are welded into place.

While this operation is in progress, complete car roofs are being fabricated, watertested for leaks, insulated, soundproofed,

and fitted with wiring and air-conditioning ducts. To make it easier for the workmen and to speed the operation, all work done on the inside of the roof is done with the roof upside-down. This is also true of the installation of air brakes, plumbing, heaters, generators, and other equipment on the underside of the floor and underframe assembly. When a roof or a floor is complete with auxiliaries, four 10-ton cranes maneuver into position 100 feet overhead pick up the member as if it were a toy, turn it over in mid-air, and deliver it right-side-up to the first main assembly position. There, roof, side frames, ends, and underframe meet and are shot-welded together to become a skeleton car. Mounted on temporary trucks, which are elevated to make underinto position and mounted with the help of hydraulic jacks that can lift the end of a car with less effort than you can lift the front of your automobile with a bumper jack. If the car is a coach, seats are installed. Then, entering another test chamber farther down the line, the car's airconditioning system is given a thorough two-hour check to make sure that everything is functioning properly.

Finally, the car is cleaned, preened, polished, and inspected. The next stop is a spur track just beyond the large sliding doors that mark the end of the "line" where a waiting switch engine takes it to the main line for delivery to one of the 16 national railroads who have coaches, sleeping cars, and double-deck observation cars on order



A finished 52-passenger coach, built by Budd for the New York Central. Coach has just been towed

off the end of the assembly line and is on spur track outside the plant. Note large picture windows.

the-car work easier, the car then begins its step-by-step progress down one of three pairs of railroad tracks that form the final assembly lines.

From that point on progress is rapid. The cars literally grow as they are moved from position to position along the tracks by portable electric winches, and different teams of expert craftsmen go to work. Stainless steel fluting and side paneling are added. Doors and windows are installed. They enter a special water-test chamber where for two hours they are sprayed with water at 45-lb.-per-sq.-in. pressure to simulate the conditions of a car speeding through a driving rain at 80 m.p.h. Interiors are installed and painted. Linoleum floors are put in place. Permanent trucks are jockeyed

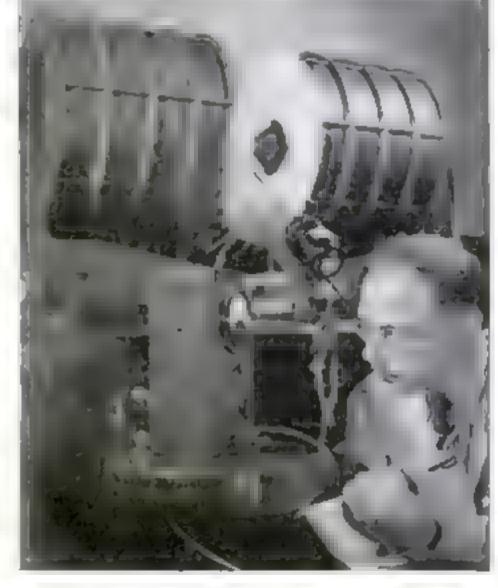
for the comfort and pleasure of America's railway travelers.

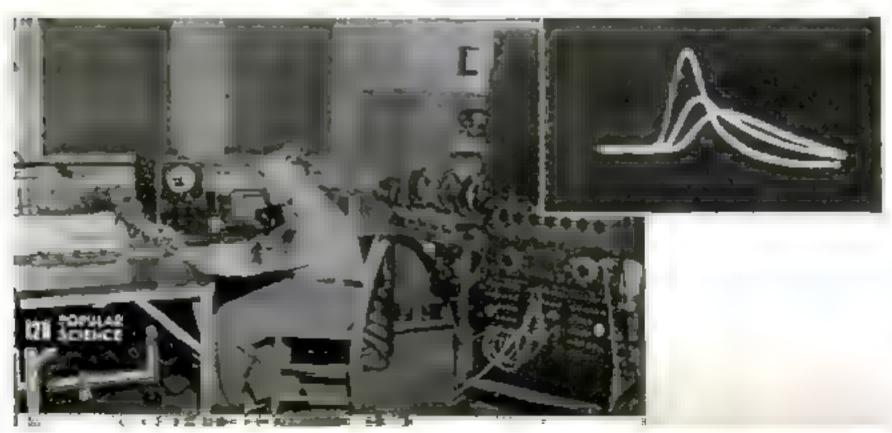
From a hundred feet up in the building's roof, the plant resembles a giant's bakerywith railroad cars for loaves. It has a giant's capacity too. Fifty-one 85-foot cars can be in progressive stages of assembly in the three lines at once. Soon a fourth will be added to produce a double-deck observation car. car. Today, full production is almost entirely a matter of getting in materials and getting up to speed. When it is reached, stainless steel in rolls stacked at one end of the plant in the morning will find itself eight bours later, wrinkled, welded, and part of a smart new 56-passenger streamlined coach or an ultramodern all-bedroom sleeping car, well on its way down the assembly line.



Magnet Concentrates Pull.
By winding a U-shaped fron core with 6,000 turns of square copper wire, Dr. J. E. Goldman, of Westinghouse, has built a ton-and-a-half electromagnet (right) that packs enough strength in a space the size of a saucer to lift a two-ton auto

Floods. To learn the ways of floods. Ohio State University assembled the apparatus below, in which electricity acts like the water in a river channel. Elements in its circuit represent river-bed friction and the channel's capacity. Oscilloscope readings (mset) allow flood crest measurements.







Bifocals Blackout Bulls. Farmers know a bull won't charge when he can't see. The Masbruch halter above, produced by the Russell Mfg. Co., Platteville, Wis., lets a bull walk and graze, but when he lowers his head to charge, his vision is blocked.



Latest Rural Head Lines





Horse Spees. Now come goggles to protect the eyes of race horses from mud clots and dust kicked up by their running mates. The spees are made by setting two Plexiglas bubbles into a regular set of blinkers. Showing off a pair, above, is Royal Hustle, first thoroughbred to wear them.

Kindly Weaner. Consisting of metal tabs that close over a calf's mouth when it raises its head to nurse, the Shur-Way weaner, left, prevents injury to the mother cow and breaks the calf of its habit without punishment. Yet in no other way does it curb the calf's freedom or keep it from feeding.

EDISON'S Magnificent Fumble

By ROBERT D. POTTER

Was the greatest accomplishment of America's leading inventor a find he averlanded?

the purbon filement of Educate lamp gave the clusto the vacuum tube.

AMERICA'S No. 1 inventor just missed one of the greatest inventions of all time. But he discovered the clue that enabled others to perfect it.

Most of those who currently celebrate the 100th anniversary of the birth of Thomas Alva Edison at Milan, Ohio, on February 11, 1847, remember him for his electric light, talking machine, and moving pictures.

Many recall, too, his stock ticker, multiplex telegraph, storage battery, fluorescent lighting, and Portland cement.

Perhaps few, in contrast, ever heard of the Edison effect, to which we owe the vacuum tube and the marvels built around it—radio, television, radar, electron microscopes atom smashers, and unknown wonders still to come

To Edison, the phenomenon that bears his



Florring's diade tube of 1904, above, harnessed the Edison effect to change alternating current into direct current. Employed as a detector of other waves, it opened the way to modern radio.

De Forest inserted a grid between filament and plate of his audion tube, below, and the radio amplifier was born. Feeble signals applied to the grid start and stop the flow of a stronger current passing through the tube.



Descendants of the two proneer vacuum tubes have transformed our lives and language "Wireless" of Marconi's time evolved into radio, is now frequently given the more precise name of AM or amplitude madulation.



Static-free FM, or frequency modulation, now challenges the supremacy of the older system of broadcasting And, some day, both AM and FM may be outmaded But the basic principle they apply—the Edison effect—lives on

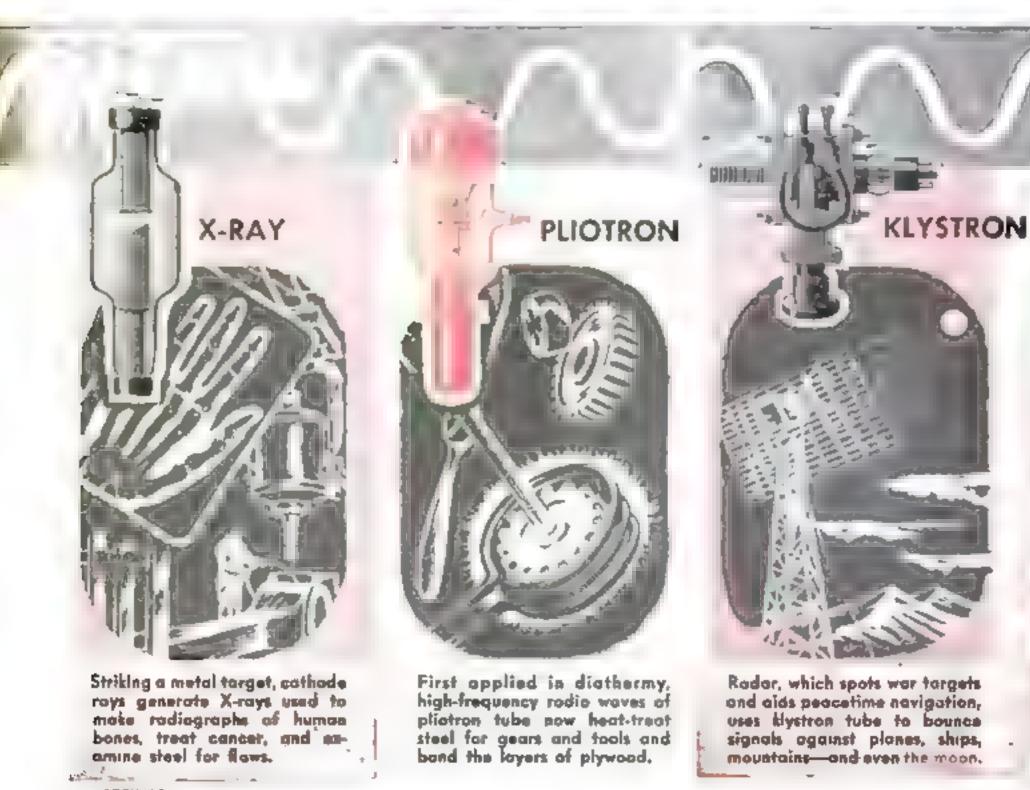
name was no boon, but an unmitigated nuisance. Back in 1883, the Wizard of Menlo Park was fretting over his electric lamp. It burned brightly for a time, then sputtered and went out. Its bulb blackened. Something was carrying the very substance of the filament across empty space to the glass.

Edison inserted a metal plate in a lamp bulb, and attached a current meter. Its needle swung. Jotting down his observation, the busy inventor hastened away to other experiments of more obvious practical importance. Had he only known it, he had in his grasp the key to the whole vast science of electronics. For the meter proved that the filament was "boiling off" charged particles—electrons, we call them now. And they would flow in only one direction, from the filament to the plate.

More than two decades later, a British physicist, J. Ambrose Fleming, awoke to the significance of this Edison effect. It provided, he realized, a one-way valve for converting alternating into direct current. Em-

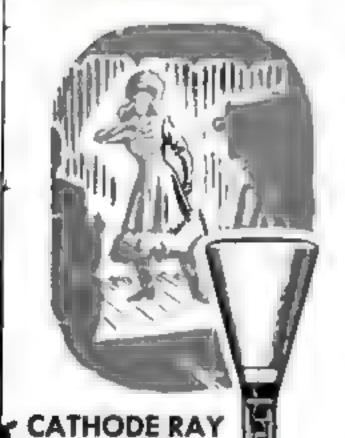
bodied in his diode or two-element vacuum tube of 1904, it supplied the practical means of detecting wireless waves that the world had been waiting for. In 1907, Dr. Lee de Forest added a third element—a grid to control the current flow between filament and plate—and obtained, in his triode or audion, an amplifier that augmented the volume of faint reception until it could be clearly heard. Listeners took off their earphones—and wireless, given new ears and voice, became modern radio.

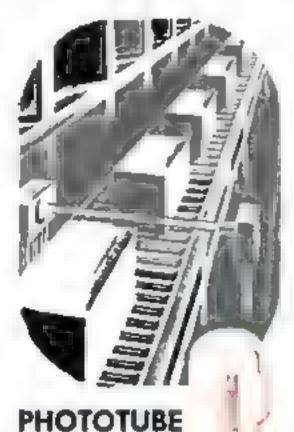
Just as truly as Fleming's diode and de Forest's triode became the main branches of the mighty family tree of electronics, so the Edison effect gave root to it. In a very real sense, the major types of vacuum tubes shown with their applications on these pages are Edison's unwitting brain children—and his greatest claim to fame may well be the discovery of a principle that will live on, even after all the inventions he made himself have been superseded by later developments and have passed from memory.



Television cameras and receivers attained quality definition when weightless beam of cuthode-ray tube ended speed limits on scanning.

Photoelectric tubes count people, cars and factory products, open doors, make sound movies, and transmit copies of messages and pictures. Electronic precipitation abotes smoke by attracting particles to plates connected with kenetron tubes, which provide a high-voltage source.







THYRATRON

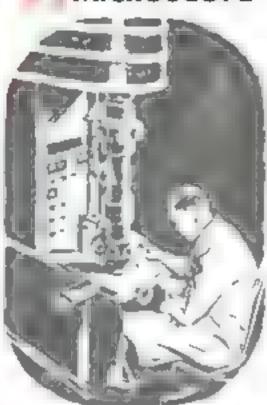


The thyrotron, a versatile tube, can handle large current output for welding, and serve as a "slave" to take orders from phototubes.

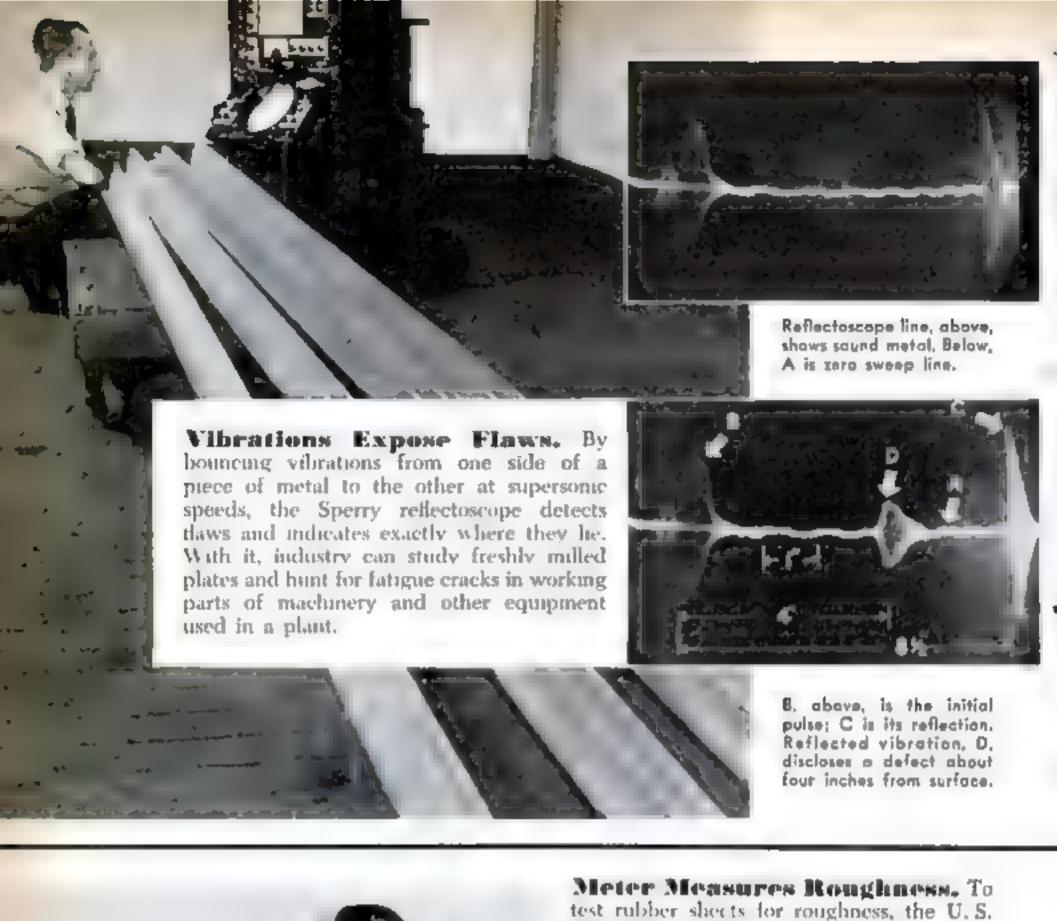


Ignitron tubes have two major functions—to turn alternating into direct current, and as a timing and switching device for are welding.

LECTRON MICROSCOPE



Allowing the men of science to probe deeper than they ever did before the electron microscope is capable of magnification up to 180,000 diameters.







Rubber Co. uses a "rugosumeter," below. It measures the resistance to compressed air between a surface and a plate resting on it.



A CROWD of 90,000 saw Bill Kitchen (right), noted British motorcycle racer, smoke up Wembley speedway in London recently (above) on the world's first rocket-assisted motorcycle

Prof. A. M. Low, rocket pioneer, and Alex Jackson, manager of the Wembley track, developed the rocket-boosted bike. The additional power is supplied by four rockets fixed over the rear wheel, two to the side. Kitchen was protected from the blast by a steel shield. Switches on the handle-

bars controlled the rockets. The race rider said the "acceleration was absolutely terrific" when the rockets let go.



AIDS TO MODERN LIVING



BASTING MEATS AND FOWL is just one use for a kitchen gadget marketed by the American Merchandise Distributors, of Chicago. Resembling an oversized medicine dropper, it also can be used to skim cream from milk, trim cakes and pustries, and water plants. The rubber bulb slips off the heat-resistant glass tube for cleaning.



SCISSORS SHARPENING can be done at home with a small sharpener produced by the South East Merchandise Co., of Lynwood, Calif. A flat guide, placed against the scissors blade, brings a slicon carbide stone to the angle needed to produce a perfect cutting edge. The stone may be turned to a new side when one is worn.



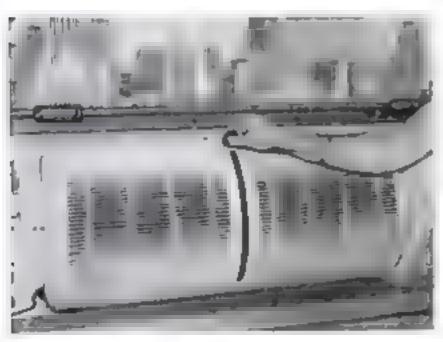
VENETIAN BLIND TAPES may be replaced in only a few minutes without removing the blind from the window or disturbing the cord. This is possible by using tapes produced by Easy Way Tapes, of Cincinnati, Ohio. Equipped with a simple fastening device, the tape is slipped over the ends of the slats, the old one is cut off, and the new one is then moved into the proper position. No tools are required to do the job.

ICE-CREAM STICKS may be frozen in the home refrigerator with an aluminum mold manufactured by Standard Products Co., of Detroit. Several wooden sticks are provided with each mold and more may be purchased separately. The molds are placed in the freezing compartment and the frozen treat is ready in the time it takes to freeze ice.





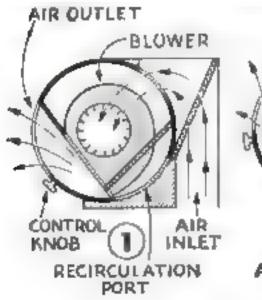
WHETHER THE SHOE FITS is quickly seen when you buy shoes for a child in a store equipped with the "Window Fit" system, developed by Step Master Shoes, Inc., of Greenup, Ill., and displayed as above. Instead of measuring the foot, or relying on guess work, the clerk slips a master fitting shoe, made mostly of clear plastic, on the child's foot. Parents then can see for themselves how it fits. With the size determined, new shoes are selected from stock.

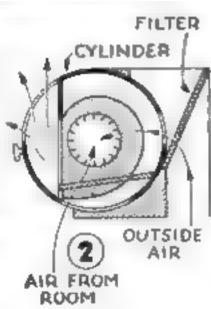


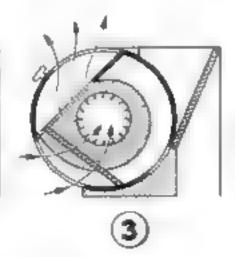
A FURNACE LIGHTER manufactured by the Lorain Furnace Lighter Co., of Lorain, Ohio, eliminates the need for kindling of any kind in starting a fire. The lighter, a gas burner connected by a hose to an outlet, is lighted and thrust into the ash pit after the firebox has been charged with coal or other fuel. The hot flame, thrown upward through the grate, is said to produce a blazing fire in only a few minutes.

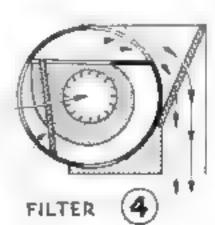


ROOM VENTILATION in any one of four ways is provided by a new window ventilator manufactured by the U. S. Air Conditioning Corp., of New York. As illustrated below, an electric blower draws fresh air from the outside (1) when the control knob is set at the bottom position. Move the knob up to the next position (2) and room air is recirculated and mixed with fresh air. Move it again (3) and you get full recirculation of room air. Last, (4) the ventilator serves as an exhaust to remove stale air from the room. Air volume is regulated by a rheostat.





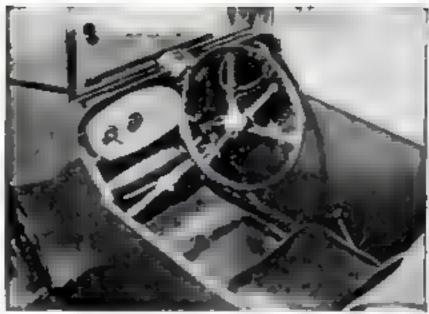




AUTO IDEAS



A SINGLE-SEAT CAR now being produced in England was designed especially for disabled persons. Clutch, brake, and throttle can all be arranged for either foot or hand control to suit individual requirements. Known as the Larmar, the four-wheeled car has a 2% hp. engine, located at the rear. It



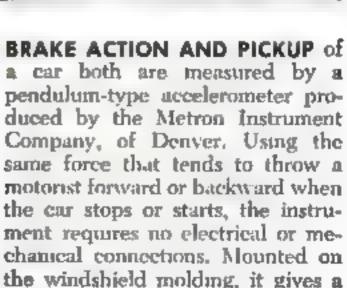
All controls in this British midget are located in the usual positions, but each can be adjusted for hand or foot operation by a disabled person.

cruises easily at 35 m.p.h. and travels approximately 65 miles on a gallon of gasoline.

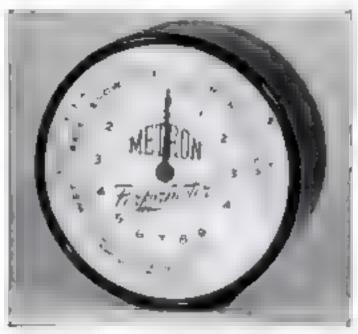
Three forward speeds are provided, but there is no reverse, since the car, which is approximately 7' 6" long and 2' 4" wide, can be turned in a 15' circle. The wheels, fitted with 4.00 by 16 tires, are independently spring and each has a cable-operated, internal-expanding brake. An extra wheel and tire are carried in the large luggage compartment located at the front of the car.

RELEASE THAT BRAKE! A dashboard signal light developed by the Eklind Tool & Mfg. Co., of Chicago, is intended to prevent motorists from driving with the parking brake on or only partly released. Easily installed on any car, the light flashes a brilliant red as soon as the ignition is turned on and continues to burn until the brake is fully released. The red cap may be removed to give a bright light for reading notes and maps. As seen below, the light consists mainly of three zinc castings.



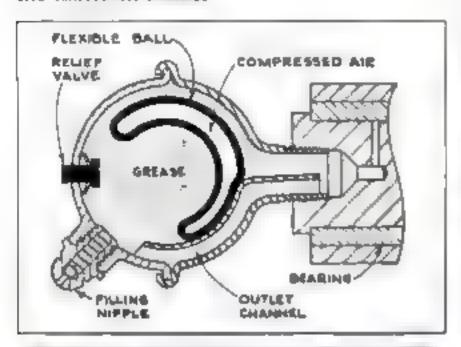


constant performance check.

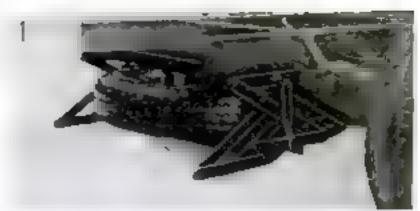


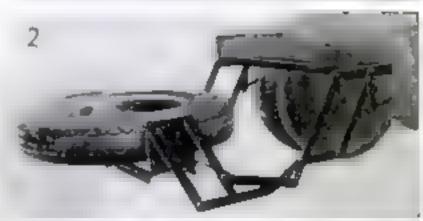
138 SCIENCE

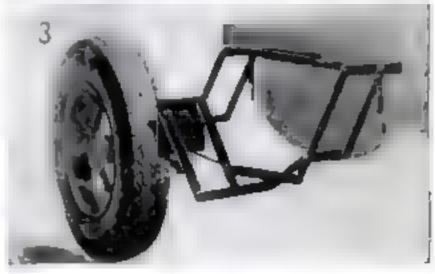
GREASE FITTINGS produced by the Samplex Mfg. Co., of Detroit, are intended to supply bearings with a continuous flow of lubricant for long periods of operation. A neoprene ball inside the cup is compressed when lubricant is forced into the reservoir with a hand or power gun. Then, as the bearing needs grease, pressure exerted by the compressed air within the ball forces the lubricant inside.











CHANGING A TRUCK TIRE is less of a physical strain with a Ted Tire Carrier, put on the market by the T.E.D. Corporation, of Los Angeles. As seen above, the carrier is bolted to the chassis frame. When the holding clamps are released, the carrier swings out and tilts so that the tire is ready to be detached and rolled away. The carriers are available in two sizes.



LUNCHING IN A CAR usually brings up the problem of a convenient place to rest the food and drink while you are eating. As a solution, the Kar-Tra Distributing Company, of Atlanta, is offering an aluminum tray which attaches to the dashboard and folds back out of the way when not in use. Polished to a fine finish, the tray measures 9" by 12" and has a raised edge to prevent objects from sliding off. Supporting the tray are an arm and two adjustable ball sockets that make it possible to raise the tray to a convenient height and level it regardless of the car angle.

GUS Slows a Speeder

By MARTIN BUNN

A LOT of folks have lived in this town all their lives without knowing or caring that the small, vacant warehouse north of the railroad station belongs to Mrs. Pomfret, perhaps because she owns so many things she needs two lawyers to keep track of her dividends.

But Peter Evans, the new pastor who took over when Dr. Hatch retired, wasn't in town three weeks before he knew all about the building and had a plan for putting it to use. The Rev. Mr. Evans had been selected for this post while he was still an Army chaplain; in no time at all he had people applauding his scheme for establishing a young folks' community center. The whole idea hinged on whether Mrs. Pomfret could be talked into contributing the idle warehouse.

Officer Tom Maloney, a burly, usually cheerful man, had one way of looking at it. He paused outside the Model Garage one morning to greet Gus Wilson with a wan,

unhappy smile.

"Why the long face, Tom?" asked Gus.
"Can it be you don't know our school basketball team got nosed out of the county championship by Remsen High? Meaning no reflection on the school, our small, over-crowded gym is no proper place for a good team to practice. It'll be a different story next year when Mr. Evans makes over a floor for the use of our teams."

"That ain't all," put in Stan Hicks, Gus's young grease monkey. "I spent a week's pay taking my girl out Saturday night. Now,

that recreation hall-"

"How's it coming?" Gus inquired, "I haven't heard that anything's been settled."

Tom shook his head. "There'll be willing hands to make the repairs once Mrs. Poinfret agrees, but there's no telling with her."

"Crazy as a beetle," Stan agreed emphatically. "Remember the time she got mad when I blew a horn in front of her house 9:30 at night? Took away her repair business because you wouldn't fire me."

"A new chauffeur every week, and every one of them begging me to make her bus less peppy. I hated to see that fine car start up like a wet sponge bouncing off a sofa pillow!"

"That's my worst worry," Tom grunted.
"It has come to my notice that Mr. Evans is addicted to speeding and fast starts."

"That could make trouble," Gus agreed.
"Has anyone spoken to him about it?"

"I have, for one. He says his car has too much pep. Had it tuned up before he left Denver a month ago."

"Denver, eh?" Gus asked with fresh inter-

est. "I worked there years ago."



140 POPULAR

"He was stationed near there. Look!"
Tom waved his club toward the corner,
where three cars glided to a stop before a
red signal. "That's him, now. The blue
sedan on the far side."

The light clicked orange, then green, and Mr. Evans' car promptly shot forward ahead of the others

"See?" Tom snorted. "There's no law against jack-rabbit starts, but it's just as dangerous as some things I give tickets for."

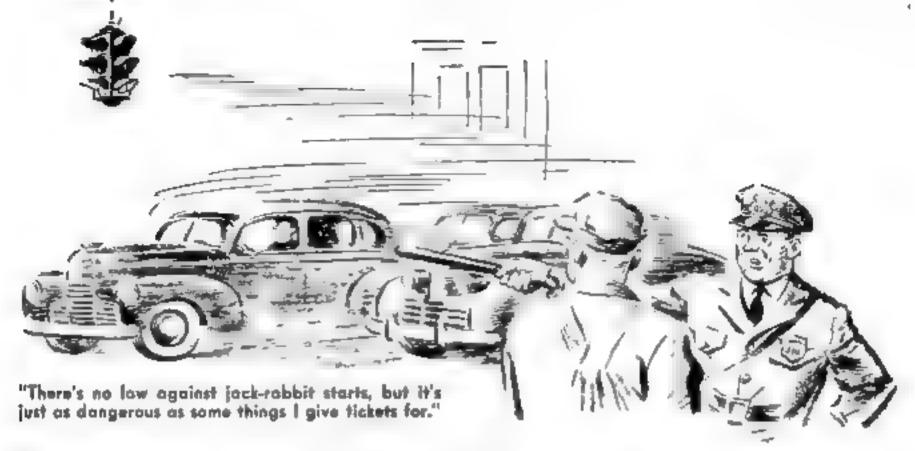
PURE chance, in the form of a stalled car, made Gus a witness to the next round in the Evans-Pornfret match. At about four o'clock that afternoon, he was summoned to Regent Street, the high-toned avenue where

our few wealthy families live. He had just finished putting in a new fuel pump when he caught sight of Mr. Evans' car easing slowly toward the Pomfret driveway across the street. Behind the smiling young pastor sat stout, bejeweled Widow Pomfret, talking graciously at the young man's back.

As the sedan nosed over the curbstone, a spotted dog cavorted dangerously toward the wheels, and the driver jammed on the brakes just in time to avoid hitting it. The dog hastily changed his course and bounded up the drive, while Mrs. Pomfret, thrown slightly forward, clutched the seat in panic

Apparently the young man was able to reassure his passenger, for she craned her head to see the dog. Nervously the driver hunched over the wheel and clashed into first. From a dead stop the car shot forward like a rocket being launched. Mrs. Pomfret was flung against the cushions, her face blanched and terrified. It took a moment to recover her breath, and then it was to utter an ear-piercing shriek.





"I'm not interested in anything you have to say! And as for the warehouse, I'd sooner see it burn down than give it to you!"

J UST what I feared," grouned Officer Maloney, when Gus recounted the scene to him the next morning.

"I've been thinking," Gus went on, "that this is right in my department. Could I have a look at his ear?"

"That you could," thundered the policeman. "I'll get it down to your shop if I have to give him a ticket."

Whether he would have done such a thing is doubtful, for Tom Maloney looked embarrassed rather than official as he escorted the Rev. Mr. Evans into the Model

Garage.
"We've got an awful nerve butting in on your business," said Gus, shaking hands with the big young pastor, "but if your car's

"I appreciate your interest," Mr. Evans boomed cordially, "but there's nothing wrong

with my car, so it must be me."

"Too much speed isn't usually a trouble."

"It is for me," the pastor replied ruefully. "My car has pretty snappy pick-up, but I can usually keep the speed down. Sometimes, though, I get preoccupied, and the next thing I know I'm sailing along like a high wind"

Gus pondered. "It might be the car. How

did it behave when you first got it?"

"I didn't notice that it had more speed than other cars. Not till I was driving back East, at any rate."

"Mind if I look?" Gus asked.

"Of course not." He dug the keys out of his pocket. "It's right outside."

Gus got into the blue sedan, started and stopped it a few times, then drove it into the shop, and got out. "Ever hear of a Denver head?" he asked, peering down into the engine.

Mr. Evans and Officer Maloney both pondered and shook their heads in unison

"Denver is about a mile above sea level," Gus explained, straightening up and dusting his hands. "Up there a regular seaboard engine with a compression ratio of 6 to 1 loses about a quarter of its rated power. To compensate, dealers shave down engine heads to increase compression to 7 to 1 or more. Your car is equipped with one of those Denver heads, and here, at close to sea level, it gives faster pickup and a higher top speed. Of course you don't get that extra power for nothing—you have to use better gas to keep the motor from knocking, and the plugs don't last as long."

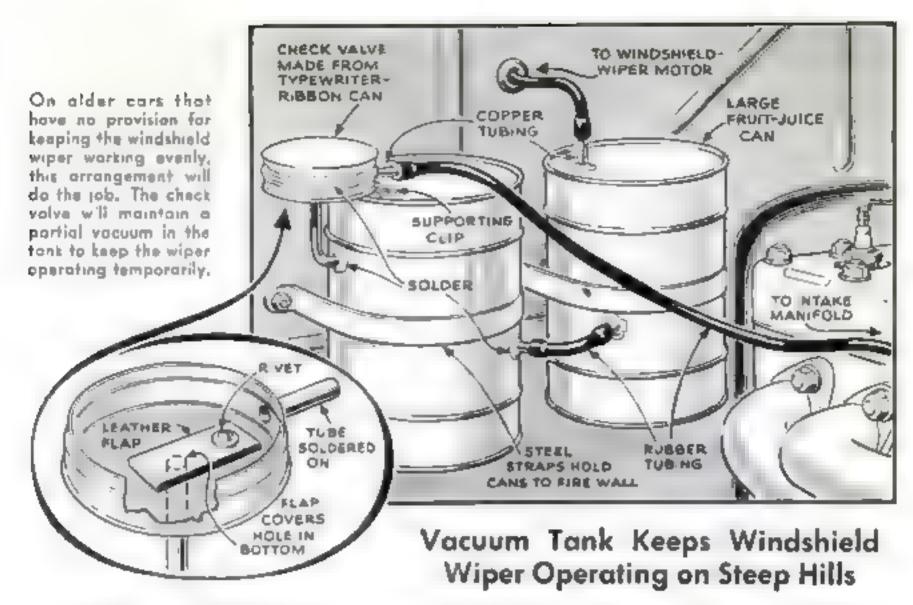
Mr. Evans laughed. "So that's what's been making a speed demon out of me!"

"In a way," Gus went on. "You see, a month or so of fast starts has also caused your clutch to grab. That, combined with the higher compression, is bound to result in jack-rabbit getaways any time you're forgetful or something happens to disturb your timing."

"Can anything be done about it?"

"The best idea might be to install extra head gaskets to cut down the compression. It will be better for the car and tires. And maybe Officer Maloney will stop thinking you're a traffic hazard—not to mention Mrs. Pomfret."

"I'm afraid I'll have to do a lot of talking before she'll trust herself in my car again," Mr. Evans laughed sheepishly. "You go ahead and put in the gaskets. I'll hate to miss the fun of beating everyone in town at the traffic lights. But I guess our new community center'll be worth it."



UNLESS equipped with a compensating valve, a windshield wiper will frequently slow down or stop whenever the throttle is opened up. This annoying and sometimes dangerous habit can be overcome by installing a tank and check valve in the wiper line to maintain a partial vacuum for the few seconds needed to keep the wiper working evenly during the slack periods. The tank should have a capacity of about 1 gal.

Two tall fruit-junce cans will give you approximately this capacity, and a check valve can be made from a typewriter-ribbon box. Out two %" holes in each fruit-juice can

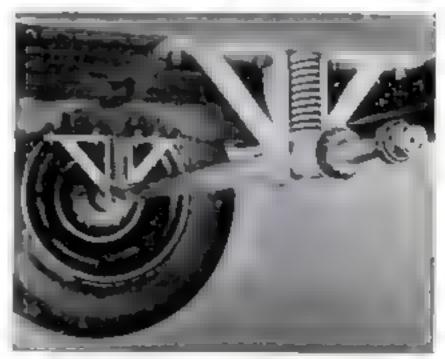
at the points indicated, drain out the juice, and rinse with water. Solder short coppertubing napples in three of the holes and a longer L-shaped nipple in the one near the location of the check valve.

Two holes also are required in the checkvalve can, one in the side for a nipple to accept the tubing from the intake manifold and another centered in the bottom to take one end of the L-shaped nipple. After the latter nipple has been soldered, remove any excess so that the leather flap valve will close tightly. Clamp the cans to the fire wall and connect the nipples with rubber tubing.

Axles for Homebuilt Trailers Have Coil-Spring Suspension

Axues and spring suspension units are being produced by the Industrial Machine Tool Co., Inc., of Fenton, Mich., especially for craftsmen who want to build their own trailers. Of all-welded construction and manufactured of tubular steel, the axles are available in either the straight type or with 4" drop for most standard wheels.

Two coil springs are contained in each suspension unit, providing four springs per axle. Although assuring a positive cushion to the trailer load, this type of springing eliminates any rocking motion. The axles have the standard 58" tread, but wider ones may be obtained on special order.



Give Your BATTERY a Break

ALL WORK AND NO CHARGE WILL MAKE IT GO HERE ARE TIPS TO PROLONG ITS LIFE.

By RICHARD W. CRANE

MOTORISTS sometimes hterally work a battery to death. Perhaps they are careful to keep the electrolyte above the plates, but all too often responsibility stops there. They overlook the fact that unless the car is operated so as to keep the rate and periods of battery discharge at a minimum, the battery will have little chance of lasting long.

In this respect, judicious use of the starter is the most important point, for a battery expends more energy in cranking a car than in performing any of the many other jobs it is called upon to do. Here are five ways you can reduce this starter drain:

When possible, park on a hill and start

the engine by coasting.

2. Depress the clutch while using the starter. This disconnects the transmission and lessens the load. On a sub-zero day, when the oil may be virtually a solid, this may determine whether you ride or walk. Even in warm weather, it will help.

3. To decrease the total load on the battery, shut off all other electrical equipment before pressing the starter button. A relay that is available commercially does this automatically, but you can do it by hand with little trouble.

In cold weather, use the light oil specified for your car. But if you are caught in a sudden cold snap with summer oil in the crankcase, it will help to pull out the choke just before stopping the engine. This should not become a habit, however, for it washes the oil from the pistons and cylinder walls.

5. Develop a technique for starting the motor when cold. If your car does not have an automatic choke, a little experimenting to determine the best choke and throttle settings will save a lot of battery wear. Generally, the choke should be pulled out all the way and the throttle slightly. When the engine takes hold, push the choke in as soon as you can without stailing the engine.

Some drivers habitually pump the accelerator while using the starter. This is unwise. For one thing, an open throttle increases the proportion of air to fuel, making the mixture leaner; and on cars having acceleration pumps, it may also cause flooding. However, on cars having such pumps it may help to push the accelerator several times to the floor before touching the starter, since this is a form of priming.

Next to the starter, the headights are the largest user of battery power. While you may use them freely any time the generator is turning fast enough to compensate for the current drawn, they should be kept off as much as possible when the motor is idling or not running. When the battery is run down and you must drive at night, switch to the parking lights whenever the engine is idling, as while waiting for traffic lights.

On some cars the current the headlights draw does not go through the ammeter. Because of this, it often may appear that

YOU CAN HELP YOUR BATTERY DO ITS BEST JOB. OPERATE YOUR

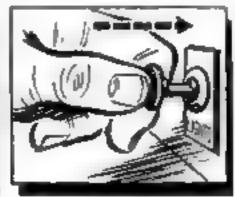
ail is heavy, the starter takes more battery power.

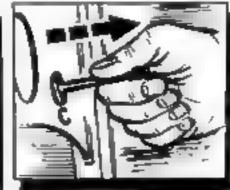
Use the right oil. If the When starting an engine, ... Then adjust the choke Next, pump the accelfirst turn off the lights and all accessories . . .

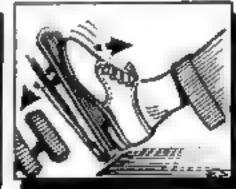
and the hand throttle . . .

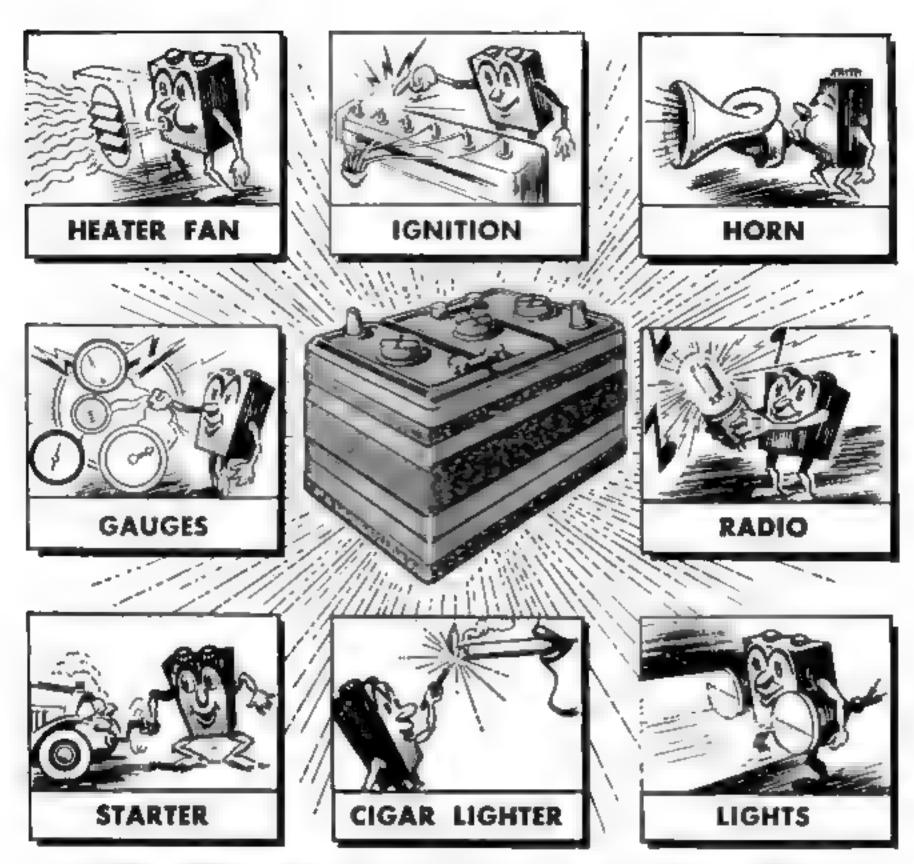
prime the engine . . .











A BATTERY SERVES YOU IN MANY WAYS. BUT DON'T OVERLOAD IT.

the battery is being charged when it actually is discharging. Check your owner's manual on this point.

As for radios, heaters, fog lights, and other electrical accessories, it is a good practice to use them sparingly. Each alone

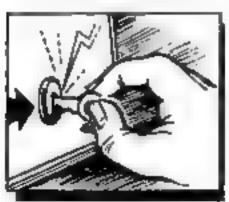
may use little power, but lumped together they take a lot; and when, at night, this is added to the demands of the headlights, dash lights, tail lights, and ignition system, the total may be greater than the maximum generator output, especially on older cars.

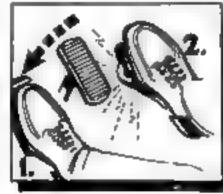
CAR PROPERLY AND THE BATTERY WILL SERVE YOU MUCH LONGER.

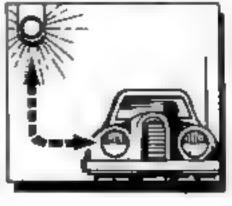
... And don't forget the Ignition, (It's silly, but a driver often does) . . .

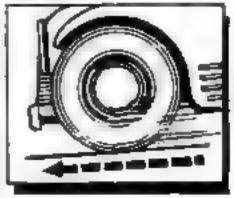
touch the starter button, when held up in traffic, the engine by coasting.

... Depress the clutch and If your battery is low. When possible, park your you finally are ready to switch to parking lights car on a hill and stort

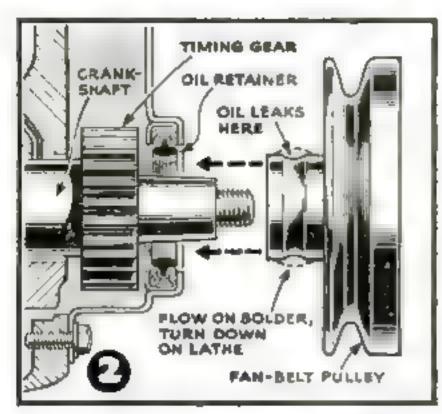


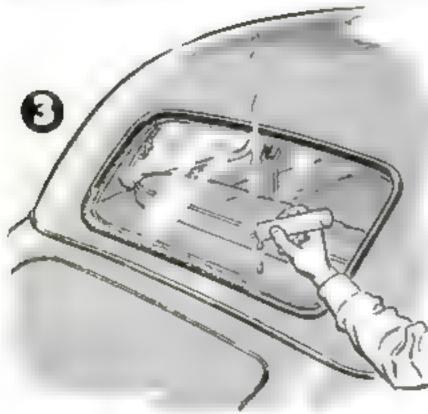




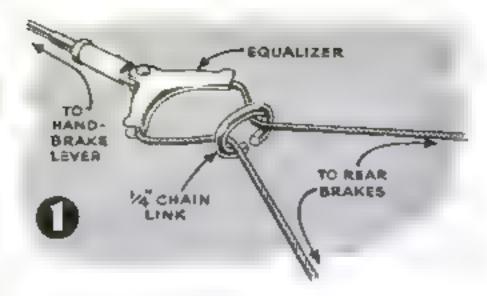


AUTO HINTS

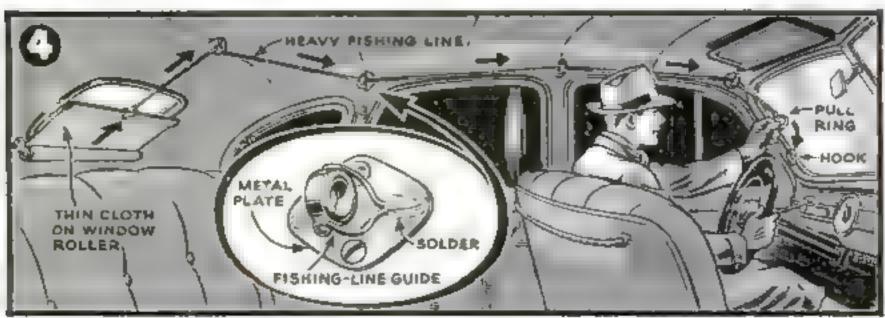




Drawings by STEWART ROUSE



- 1. HAND-BRAKE CABLE SLACK can be taken up when no more threads remain in the clevis by slipping a k" chain link over the cable near the equalizer. By pulling the cable together this provides 1" more of threads for adjustment. Use a replacement tire-chain link, and bend it closed after installation.—H. C. Weber.
- 2. SOLDER ON THE WORN HUB of a fanbelt pulley will stop an oil leak when grooving by the oil retainer after long service has destroyed the seal. Build the hub up well with solder; then turn it down in the lathe, leaving it a little high to make up for wear on the retainer itself.—R. L. McClannan.
- 3. RAIN-LEAKING REAR WINDOWS and windshields can be plugged with wax dripped from a candle into cracks in the rubber seal. Drip the wax on for several inches on both sides of the breaks. Until the sun melts the wax thoroughly, the leak won't stop completely.—C. D. Bassett.
- 4. REMOTE REAR-CURTAIN CONTROL enables a driver to shut off glaring headlights from a car behind and to reopen the shade and restore rear-view vision when the car has passed. The pull cord is a heavy fishing line threaded through a series of casting-rod line guides on metal plates.





- Your Own Copying Camera
- Aluminum Serving Tray
- Magazine Rack and Smoking Stand
- De Luxe Crystal Sets
- Fixing Balky Doorknobs

It Serves You Right

ALUMINUM-AND-PLASTIC TRAY HOLDS GLASSES AND ICE.

By Bill Luther

STAINLESS aluminum and clear plastic, both available as war-surplus stock, are combined to make this serving tray, which may be tailored to fit your favorite glass-ware. The base is of corrosion-resistant .080" aluminum alloy, the feet and handles are round bar stock, and the upright spacers are tubing. An 11" by 17" sheet of K" plastic is bored to receive the glasses and an ice container and to act as a guard.

File the edges of the alloy smooth and round each corner slightly. Then, to impart a brushed finish and remove scratches and stamping, sand the best side with coarse sandpaper, taking all strokes evenly and lengthwise. Lay out and drill 14 No. 12 holes, remove the burrs, and wash thoroughly with hot water and kitchen cleaner, rubbing in the same direction as when sanding. Dry with a soft cloth, and from then on handle the piece by the edges to avoid finger marks. The bottom may be covered with cemented gray felt.

alloy bar. Drill a No. 21 hole through each piece, tap 10-32, and counterbore for a depth of 1/16" to take a disk of leather, cork, or rubber as a safeguard against scratching table tops. Cut two 8" lengths of %" diameter bar for the handles, drill two blind holes radially in each, and tap also 10-32. The uprights supporting both the handles and the plastic shelf are cut from %" aluminum tubing. Make the handle spacers 1%" long and cut one end concave with a %" end mill or round file to fit the handle. The shelf spacers are 1%" long.

Without removing the protective paper covering, lay out the clear-plastic shelf guard carefully for each piece of glassware to be used, taking the diameter of the pieces 2" from the bottom. If the glasses are footed or otherwise larger at the bottom than at the point measured, the holes must be large enough to let that part through. Lay out also six screw holes at the corners and midway at the sides, marking through the spacer holes in the aluminum bottom as a pattern. Then, using a hole cutter in the drill press, bore a little beyond halfway

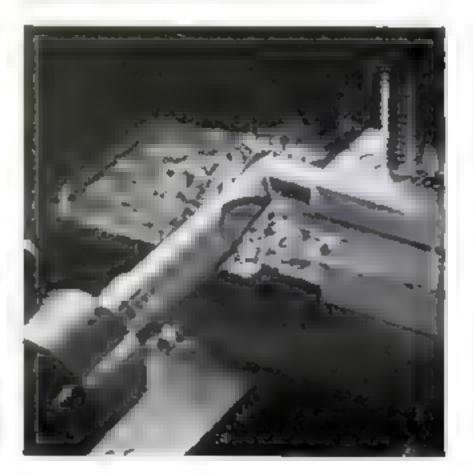
For a brush finish and to remove markings, sand the best side of the aluminum-alloy bottom with coarse sandpaper. Make even, lengthwise strakes to get a uniform finish on the metal.

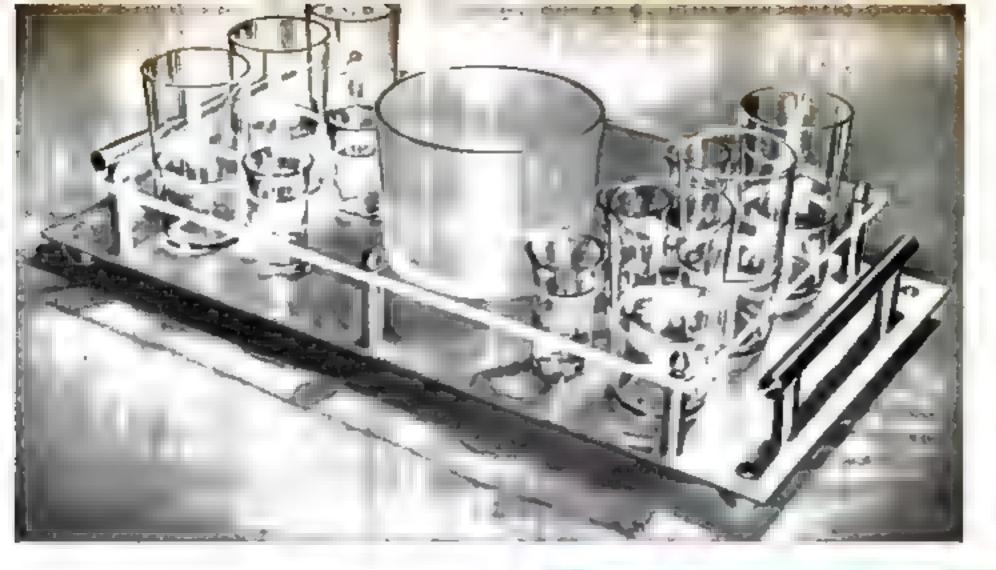
Turn the feet from 1" drameter aluminum-

Uprights supporting the handle rade are machined concave to fit the handle diameter. Here the job is done on the tubing with a ½" end mill. A round file could have been used as well.





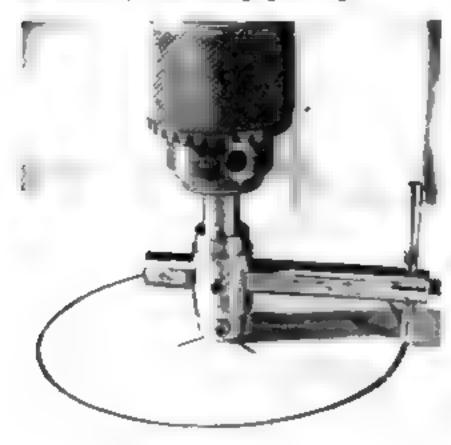


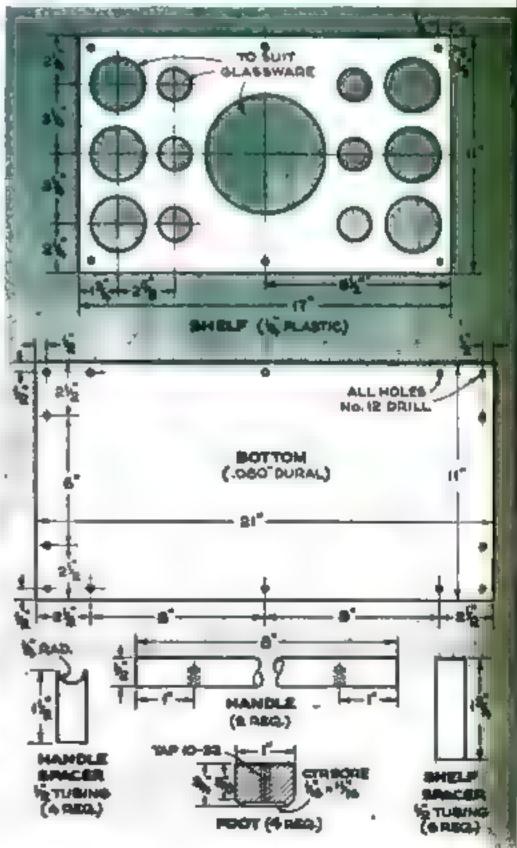


for the glass holes and finish from the opposite side to prevent chipping as the tool breaks through. Likewise drill No. 12 spacer holes first from one side and then from the other. Before removing the paper, wet-sand all edges smooth.

Assemble the parts with cadmium-plated buttonhead screws, washers, and hexagon cap nuts. Use 2%" screws head down for the shelf, bring up the parts carefully, 1%" screws in the handles, and %" screws in the feet. Glue protective disks on last.

Cutouts for the glasses are made in the plastic with a drill-press hale cutter. Half the cut is taken from one side, and the hale is finished from the other to prevent damaging the edge.





NEW TOOLS

HAND TAPPER. Accurate duplicate work is accomplished with the tool shown below, for the adjustable arm can be raised and swung to the right or left without disturbing the setting of the taps. According to the manufacturer, the Viking Tool & Machine Corp., of Belleville, N. J., the tapper is five times faster than a wrench. Square alignment of the taps with the work in all positions is said to reduce tap breakage.





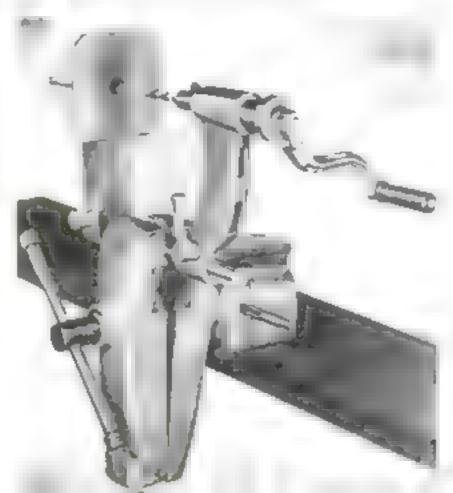
150 POPULAR

NEW GAUGE, Made by the Read Machine and Tool Co., of Los Angeles, this device measures the size of hex and square bolts and nuts, length of bolts and screws. threads per inch, diameter of rods and shafts, the pitch diameter of nuts, and hole and washer sizes. It is made of dural and stainless steel to cover %" to 1%" sizes and lengths up to 4".



MODELMAKER'S DRILL PRESS. This light-duty press, offered by Richter Tool Company, of New York, drills to the center of a 5%" circle and has a spindle travel of 2%". The head may be raised to take up slack in the V-belt, and both the adjustable table and the base have a center hole and diagonal slots. Standing 23" high, the press takes up only 3%" by 10" bench space. A %"-capacity Jacobs chuck and pulleys are provided.

VISE AND DRILL. Two separate units are combined in one tool manufactured by W. H. Howland, of Chicago. Each unit can be detached and used individually as a portable tool, or the two together provide either a horizontal or vertical drill press, the vise turning 90 deg. for vertical drilling Both head and base of the drill adjust on the rod supporting the two, and the vise will grip the rod above or below the slide.



Metal-Ornamented JEWEL BOX

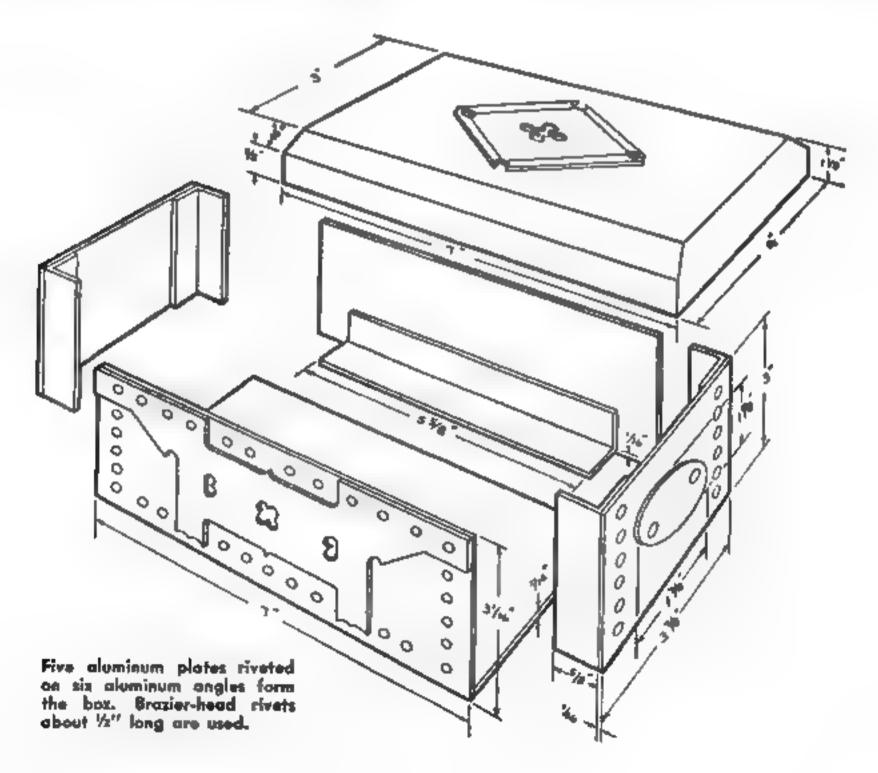
A MODERN material and an antique design are combined in this rivet-studded box to make a distinctly original craft project. The box itself is of .064" aluminum sheet and extruded angle, while the top is a hollowed block of maple.

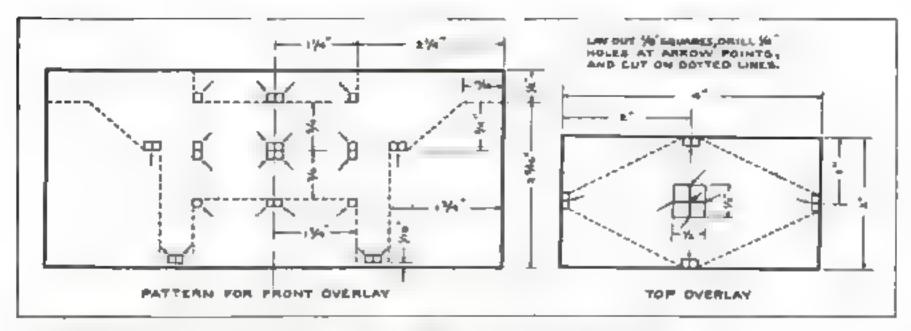
Cut the front, back, ends, and bottom to size, and cut pieces for the front and top overlays and the oval end plates. You will also need four %" by 3" angles and two %" by 5%" angles. Lay out the front, ends, back, and bottom for rivet holes. Six at each side edge of the back, 11 at its lower edge, and holes for hinge rivets are sufficient for that piece, while the bottom need only have



enough to care for the front and back angles. Drill these holes and use them as templates for drilling the angles and overlays.

Two methods of riveting are suggested in the drawings. A rivet set can be formed from a short length of bar stock having one



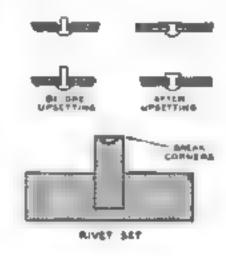


Overlay plates for the front and top are drilled and cut out from the patterns. A rivet set and two methods of riveting are shown at right.

end hollowed with a hand grinder and set in a base plate or held in the vise. Holes countersunk from the inside provide a neater interior. Hold the work squarely on the rivet set, for tilting will mar the outside with a ring around the rivet head.

Rivet the corner angles to the ends first, rivet the overlay and bottom angle to the front next, and then rivet the bottom angle and hinges to the back. A single piano hinge may be used, or you may prefer a pair of old English hinges. Hold the work with machine screws while putting in the first rivets and keep holes clean and free of burns.

Rivet the ends to the front and then to the back, and add the bottom last. Drill the maple slightly undersize, flatten the rivet ends, and drive home with a mallet.



Rub the glaze off the aluminum with fine steel wool and heavy oil, working in one direction only. Sand the maple smooth, and then wax. Cement felt on the bottom and add a cloth lining inside.—R. J. DE CRISTOPORO.

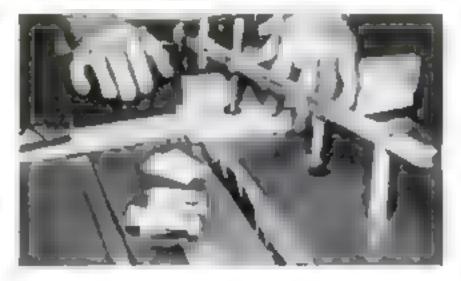
Chair-Leg Tenons Are Kerfed and Wedges Cut on Circular Saw

ROUND tenons, such as the ends of chair legs that are to be anchored with wedges, can be kerfed quickly on the circular saw. A tenon jig consists of a short length of 2" by 3" stock bored through the 3" face and slotted from end to end so the saw blade will pass through the center of the hole. Admist the saw fence, insert the tenon in the hole, and slide the jig against the fence to pass the tenon end over the blade, as in the photo at left below.

Wedges may be made from scraps of fairly

wide hardwood boards. Saw these across the grain in strips as wide as the desired length of the wedges and as thick as their width. Set the miter gauge a few degrees off square and take a first slight cut to establish the angle of the side of the first wedge. Clamp a stop block to the table as a wedge-thickness guide, and saw wedges by flipping the stock over with each cut until the stock becomes too short to handle safely. A hold-down may be useful, as in the photo at right.—John P. Arnold.





152 SCIENCE

Puppet Dances with the Wind

By HI SIBLEY

BESIDES indicating which way the wind blows, this weather vane provides a unique dancing show that will delight the young and fascinate their elders. A re-

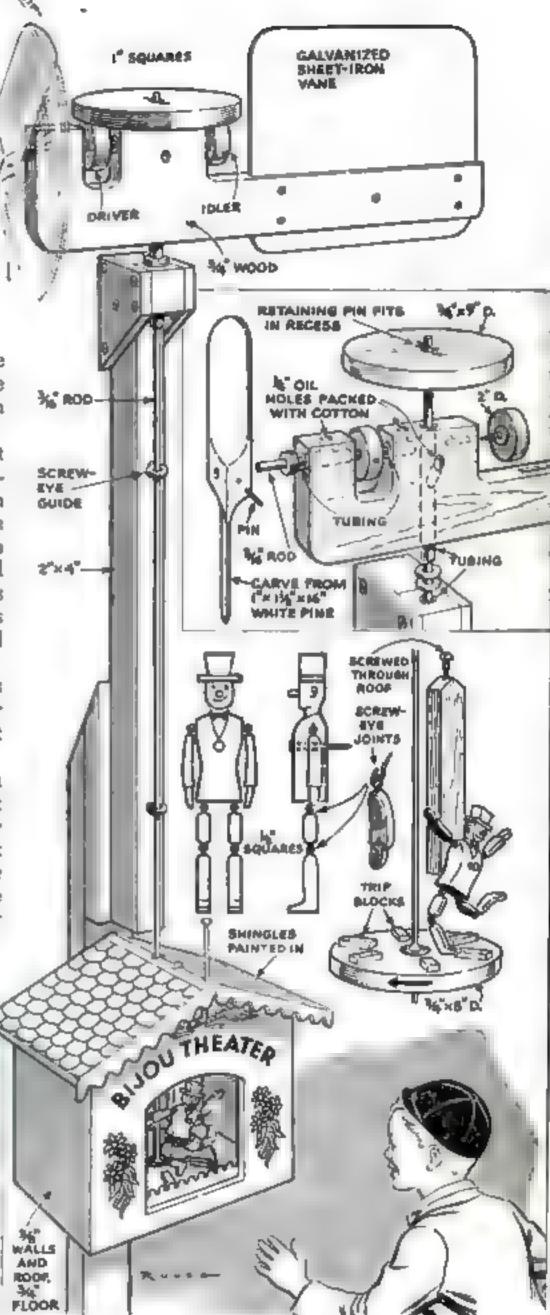
volving platform to which trip blocks are glued causes the limber little figure to dance incongruous and unpredictable steps when the wind spins the propeller above.

The propeller is mounted on an offset post and transmits motion to the trip-block platform through a vertical shaft turning in screw eyes. At the top of the shaft is a wooden disk anchored with a retaining pin fitting in a recess. It rides on a roller keyed to the driver and also on an idler. No gears are employed, and the entire action depends on the weight of the revolving disks and shaft on the rollers.

Tubing, preferably brass, forms bushings for the driver and vertical shafts. The idler turns on a screw. A vane is cut from a sheet of galvanized iron.

Whittle the propeller and the figure from white pine and join the arms and two-part legs of the figure to the body with screw eyes. Attach the little dancer to a block with a screw put through an oversize hole and suspend the block to the roof of the theater with a screw. Assemble the theater with brads and waterproof glue.

ROD THROUGH HOLE IN FLOOR





This model of a firearm for settling gentlemen's disputes may be kept in a glass case or screwed from behind to a plaque.

Old DUELING PISTOL Whittled from Wood

By CARL G. ERICH

DUELING pistols have long held a fascination. The original of this model had no dates or identification marks of any kind on its plate, but it was probably designed somewhere between 1825 and 1830. It is believed to be of German origin, and was evidently made by a real craftsman. Since it always took two to have a duel, you may wish to curve a pair of models.

Because of the fine carving and engraving, it is best to make the models full size. Two blanks 13/16" by 4%" by 13%" will be needed for each. Trace the drawing on the blanks, reversing the outline on that for the left side and substituting the left plate for the one to which the hammer assembly is attached. The hammer is made separate and fastened with glue and a slot-head dowel.

Jigsuw the two blanks just outside the outlines. Then glue them together, spreading glue on both halves, anchoring with two brads to prevent slippage, and clamping.

Cut half-section templates N, O, and P from cardboard, and start shaping the barrel first, using the glue line as a centerline Leave a little stock on for carving, such as at A, C, D, E, F, G, I, and the left-hand plate. These are in relief to give a raised appearance. They may be grooved with a veiner or an electric wood-burning needle. Such an

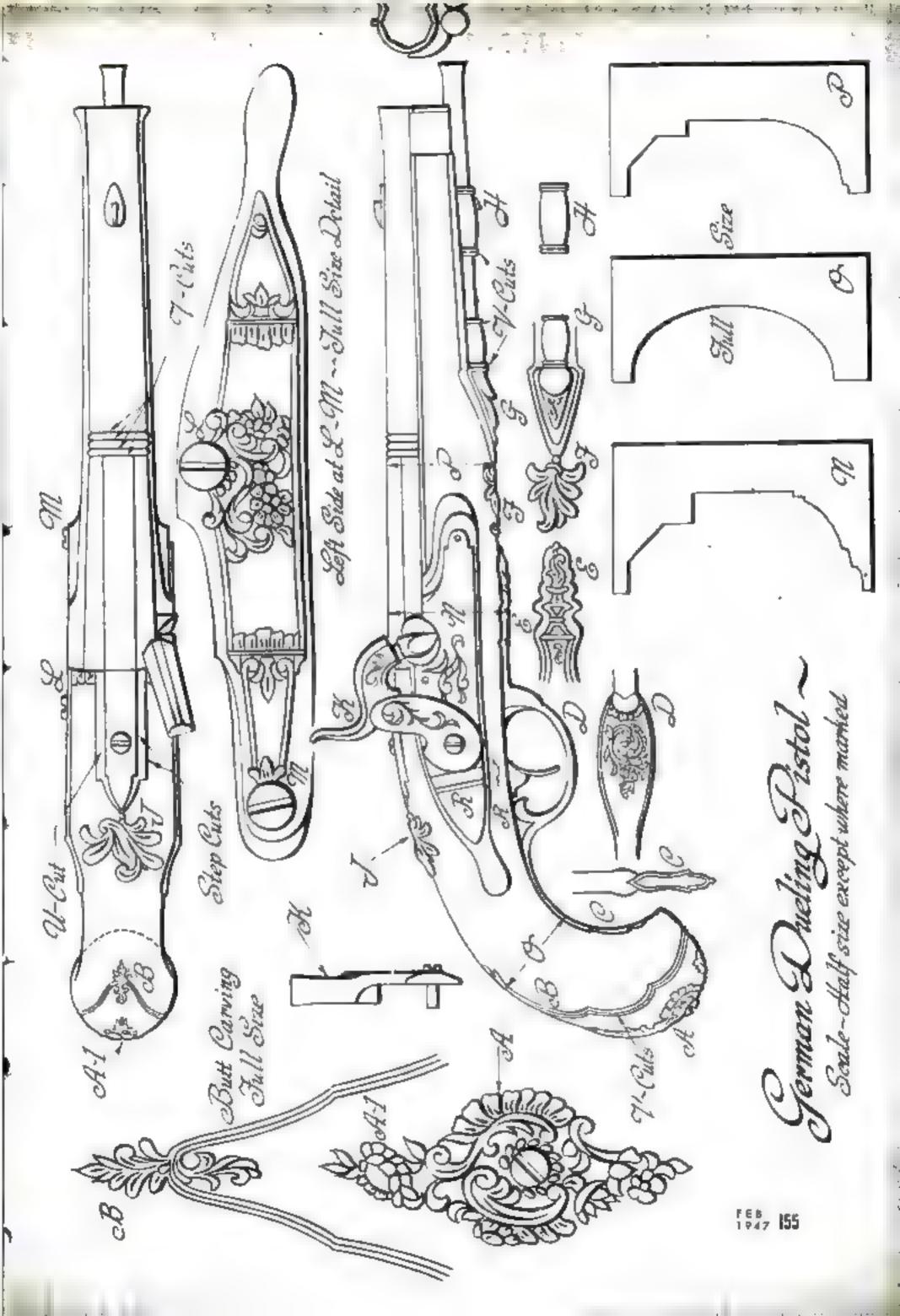
iron is a great help when used in connection with a sharp jackknife.

Shape the trigger and guard last, cutting across the grain to avoid splitting. If the parts should split, glue them together and let the glue set before proceeding further.

Note the slight blunderbuss flare of the barrel at S, indicating that the original was a short-range pistol. The riflings are octagon shaped, cut with a chisel after drilling undersize about 3" deep. Sand the piece well; then carve and attach the hammer.

For the colors shown on page 120, coat the right-hand plate, hammer, barrel, ram-rod, cap holder, and inside of the barrel with liquid stove polish. After drying, rub in liberally powdered graphite, using a pointed stick to get it into corners and taking care not to blacken other parts. Apply liquid bronze darkened with a little stove polish or lampblack to the left plate, A, B, C, D, E, G, H, and sight, and coat the remainder with walnut oil stam.

A coat of clear varnish is applied to the stained parts and smoothed with fine steel wool. Then these parts and those treated with stove polish and graphite are again varnished. Rub the stained parts with fine steel wool and oil and the "metal" parts with steel wool alone; then give the blackened parts another light rubbing with graphite for a blued-steel effect.



NOTHING WOODEN about the action of these five cats, though they're all made of wood by Bob Kuntz, of South Bend, Ind. He turns and carves the parts from basswood and mounts them on walnut bases. Shellacked tempera colors give the high gloss. A little brass wire used on the instruments is the only nonwooden material required.



CRAFTSMEN at WORK





TIN-CAN STOCK was the material used in the post lantern shown here, one of a pair made by Charles H. Lohmeier and a neighbor in Lakewood. Ohio. For the inspiration, they went back to an original design by Dr. W. E. Ballard, of Denville, N. J., in the Aug. '42 issue of PSM. Posts on which the new lamps set are 3" downspout embedded in and filled with cement to give them more rigidity.

THIS PORTABLE DRAGSAW was the answer for Howard P. Brown, of Hudson Falls, N Y, when he bought a wood lot that had been lumbered and was covered with large tree tops. He had acquired a 1%-hp. gas engine about that time, and then along came the Oct. '45 PSM with its plans for a portable dragsaw. Brown followed the plans, adding a %" pipe to the blade for extra weight to reduce whip and increase cutting with his somewhat huskier engine. The result was that the unwieldy tree tops were systematically reduced to fireplace lengths, two fireplaces were kept going, and a surplus was stocked for succeeding winters.





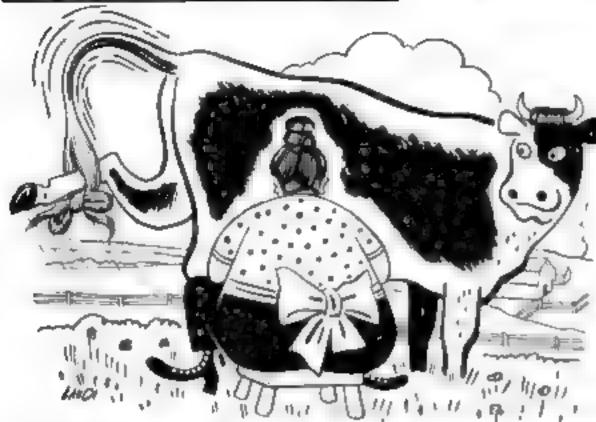
AS A FIRST BOAT PROJECT, one of which he is naturally proud, T. S. MacFadyen, of Ossming, N. Y., built this little cabin cruiser and put it into service as a pleasure craft on the Hudson River. The sleek little cruiser is powered by a 9.8 - hp. outboard motor. Original plans for the vessel were published as a four-part series on small-craft building in PSM in Feb., Mar., Apr., and May '39.

158 SCIENCE

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the hame, shop, garage, or camp. It doesn't matter if it's wacky—if it works.

WHAT'S YOUR INGENUITY QUOTIENT?



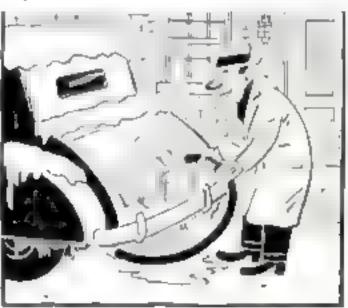


It's A SAD TALE, but one that's familiar to every farmer who has ever tussled with a cow. After being swatted and switched until it seemed that Bossy's tail was made of lead pipe wrapped in steel wool, one last switch swatted this idea into my head. Now I separate her tail into two strands and knot it around her left leg.—Wally Wallingford.

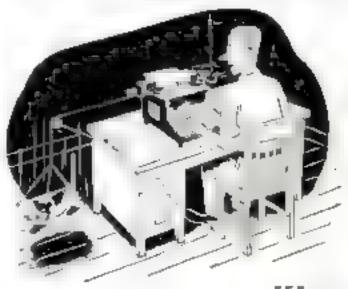
I FINALLY BLEW UP when a flock of feathered pirates turned my fruit tree into a free-lunch stand. To discourage their visits, I use a small transformer and a spark coil to spark a firecracker fuse under a tin lid of pebbles, and now when the burglars gather, I just turn on the juice. It doesn't injure the birds, but it does wound their dignity. The news seems to have been tweeted around, for local birds have adopted a "beaks-off" policy toward my fruit.—E. T. RICHARDSON



A WEIGHTY SOLUTION was needed when the carriage-return mechanism of my typewriter quit in the middle of some important typing. Until I could have it properly repaired, I did my work with a weighted string pulling the carriage back.—JOHN A. BLAKER.



i THAWED THIS OUT myself one icy morning when the lock on my car trunk froze up. Heat from the exhaust, piped through a length of garden hose, warmed the lock in a lot less time than it took for the car to warm up.—Ora Henacer.



Whittled Frog Paperweight Dispenses Clips and Thumbtacks

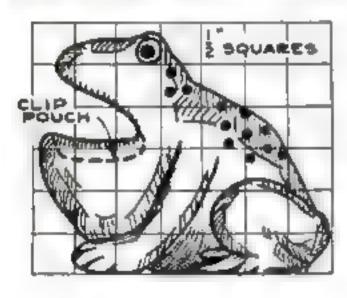
ALL blown up and apparently ready to make with a loud "Chug-a-rum," this frog will instead present you with paper clips, thumbtacks, or other desk accessories held in its amply hollowed larynx. Drilled from the bottom with several "holes, which are

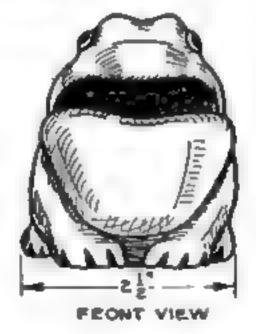


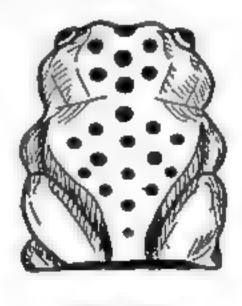
filled with lead shot and plugged with gluedin dowel disks, the frog will also perform the auxiliary service of paperweight. Save the weighting until after the carving has been completed, but do it before painting.

Softwood is best since it is easily worked and finer wood would not show anyway under the paint finish. It should be a block 2%" by 3" by 3%" and may be either solid or glued-up stock. Saw out the profile and carve the contours, turning the work frequently to preserve symmetry. A sharp jack-knife is the only tool really needed, but a set of chisels makes the work easier, especially when hollowing the throat cavity.

Sand the piece smooth without destroying the separation cuts and the angles, and then paint. The vest, pouch, inner portions of legs, and inside the mouth may be ivory and the remainder a lettuce green. Apply the darker paint first, and blend the lighter into it at the edges. When the second coat has dried, put in the spots with gold paint and the eyes with black and white, or use thumbtacks for eyes.—Elma Waltner.





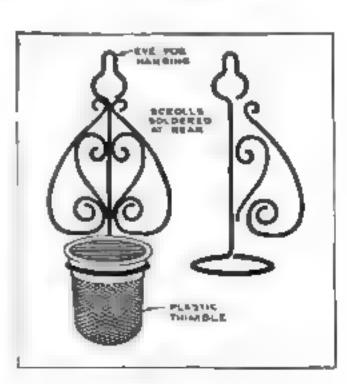


REAR VIEW

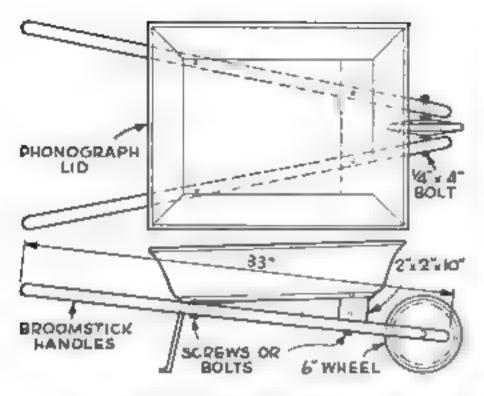
Thimble-Size Bracket Holds Flowerpot

Tiny dried everlasting flowers or Mexican flowers are best displayed on a whatnot shelf in a container scaled to their size. A sewing thimble—one of red plastic—is ideal if fitted with a scroll bracket bent from light-gauge copper wire, which is easy to work with roundnose pliers.

Bend five lengths of the wire to the shapes shown full-size in the drawing at right, and solder the parts lightly together with a drop of solder at the back of the joints. Before inserting the little thimble flower-pot, the bracket may be given a coat of black or white enamel.—Charles H. Hardy.



158 SCIENCE





Lid from Old Victrola Forms Body for Child's Wheelbarrow

With the exception of screws and bolts, all the materials in this child's wheelbarrow are discarded pieces. The wheelbarrow body is the lid from an old Victrola, the shafts are two old broomsticks, the wheel is a clothesline pulley tired with cemented rubber trim salvaged from an old automobile

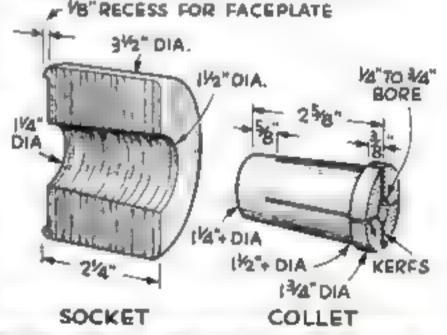
door, and the legs, which may be made from any suitable brackets, are stands from a chicken feeder. Screws or bolts holding the shafts to the body at the front are put through a scrap length of 2" by 2" wood. 'A K" by 4" bolt with washers for spacers serves for an axle.—Vennon F. Underwood.

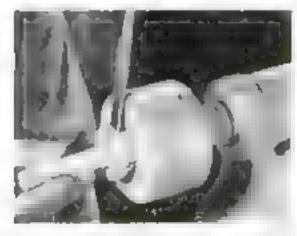
Set of Wooden Collets Holds Dowel Mandrels in Lathe

When dowels are used frequently as mandrels, a tapered socket and set of collets will provide a way for quick centering of standard sizes from X" to X" in diameter. Glue up three plywood disks for the socket, mount on a screw center, and recess the face to receive a small faceplate, which may be screwed on permanently if another faceplate is available or recentered accurately in the recess if detached. The socket is completed on the faceplate by boring the taper with a narrow skew chisel.

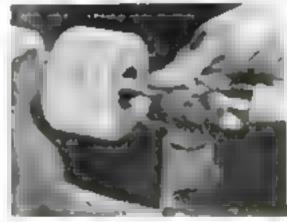
Bore a set of hardwood squares to the desired sizes for the collets; then turn a wooden arbor to fit the largest, force the blank on it, and turn. Reduce the arbor to fit the next size and turn it, and so on to the smallest.

Then kerf the collets and finish with shellac.
With a dowel inserted, a collet is tapped into the socket. After the job, the collet is pried out and the dowel stub removed.

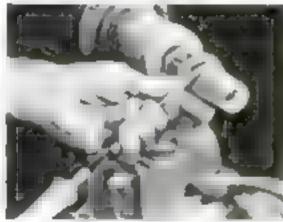




Put a chisel behind the shoulder to pry a collet from its socket.

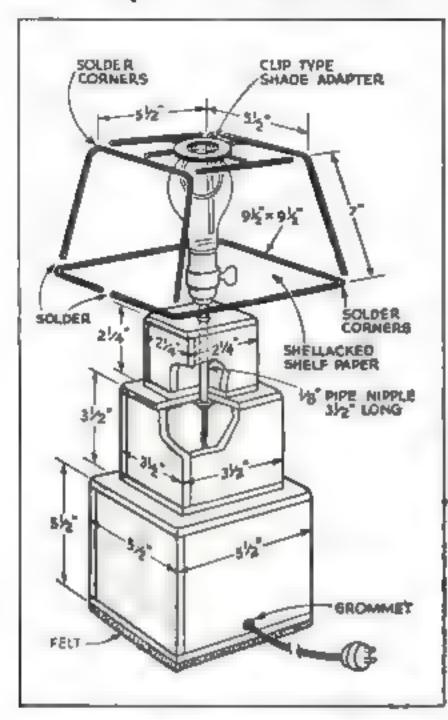


The toper in the socket hole is bored with a narrow skew chisel.



Collets are shaped from hardwood blanks mounted on an arbor.

Lamp for Child's Room Has Base of Built-Up Toy Blocks



With joints like these, four sides exactly the same are cut for each box. Sand poured in the lowest or sheet lead screwed to the bottom before the felt is glued an prevents top-heaviness.

THREE built-up boxes painted like toy blocks form the base for this lamp designed for a child's room. The shade is shelf paper glued on a soldered frame and shellacked.

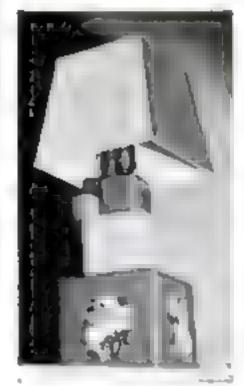
Any %" to %" wood on hand will do for the boxes. Line up the three lids and the small and middle-size bottoms for drilling. Assemble with glued-and-nailed butt joints; but before attaching the lid of the middle box, make a trial assembly with a 3%" long pipe nipple through the top box. Adjust the nut to provide threads for the socket.

Round all corners and edges except on the three bases, and sand smooth. Apply two sanded coats of enamel undercoat; then finish with color—a combination such as the apple green, canary, and cherry shown on

> page 120. Leave the bottoms and a square on the hds unpainted for gluing surfaces between the pieces.

Make the frame of heavy coat-hanger wire. Scrape bright and free of paint for soldering. A clip-type shade adapter is soldered to the top frame with short lengths of supporting wire.

—Z. S. Gierlach.

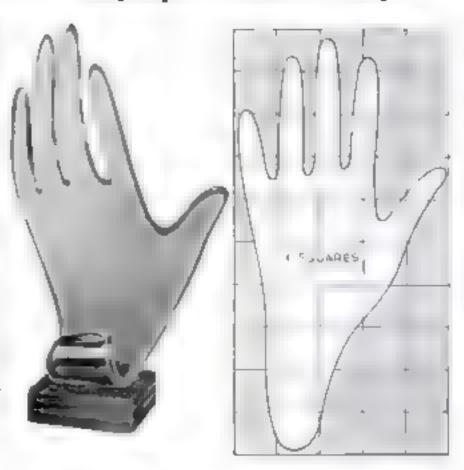


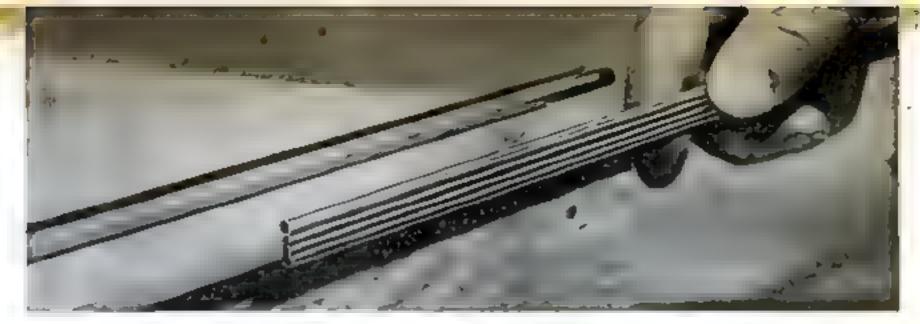
Plastic Hand on Dressing Table Displays Costume Rings

MADE from 3/16" clear sheet plastic, the hand-shaped ring holder shown here and in color on page 120 is a glamorous and practical dressing-table accessory. It could also display rings effectively in a store.

The piece is sawed to shape, and all edges rounded with a file, sanded smooth, rubbed with fine steel wool, and buffed while the masking paper is on. Remove the paper, heat in a moderate oven, and curve, shaping the wrist to a graceful scroll

Three thicknesses of the same plastic are cemented together for a base, which may be about 3" square. All surfaces are filed, sanded, and rubbed with steel wool. The resulting frosted finish provides a nice contrast, but the base may be buffed clear if desired. Cementing the hand in place completes the project.—Doris Aller.





Flat task rods are slipped on to trim wallboard. The skarp-edged sliding flanges hold them in place.

Moldings from common materials

FLAT curtain rods, narrow strips of brass or zinc linoleum binding, and even leftover pieces of plain-colored linoleum can be used for finish trim at a fraction of the cost of regular decorative molding.

Curtain rods especially come in a number of suitable designs, and often at a cost of only 10 cents for several feet. Cut off the curved ends first and drill screw holes for applying to the edges of counters, table tops, and the like. Flat sash rods can be slid on the edge of wallboard, composition board, and plywood panels, where they will hold by friction alone.

Seam bindings of brass and zinc are available cheaply in rolls and can be attached with brads or linoleum cement. Strips of linoleum similarly used may require enameling on the edges.—Kenneth Murray.

A loist between laner sections of purtain rade

in insupensive rolls and can be bradded on.

A joint between Inner sections of curtain rods is hidden by a piece from the wider section. Align butted outer parts on pieces from an inner one.

finaleum is another good edge molding, it comes

Sections of flat curtain rods may be drilled and screwed on where an edge molding is accorded. Many attractive designs are available.

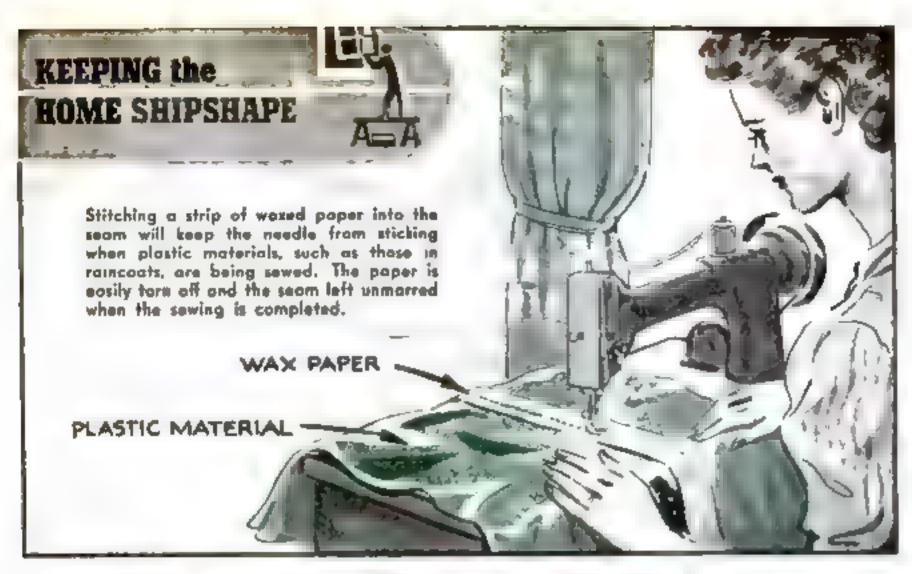


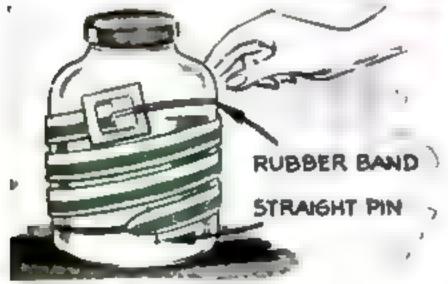
When a length of flat curtain rad is bent around a sharp corner, a V-section notched in the flange with a triangular file assures smoothness.



FEB. 161







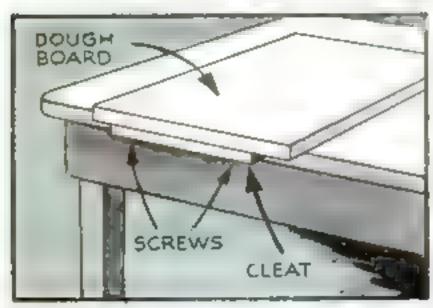


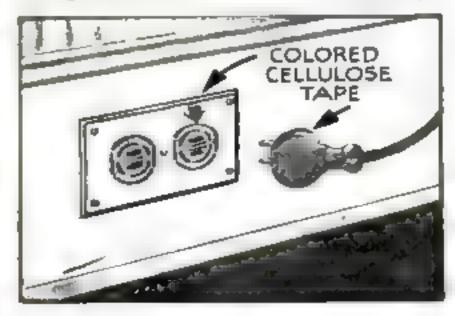
GUMMED LABEL

Belts on wash dresses, especially those having an imitation-leather lining, tend to roll along the edges when drying. This can be eliminated if they are stretched around a jar to dry.

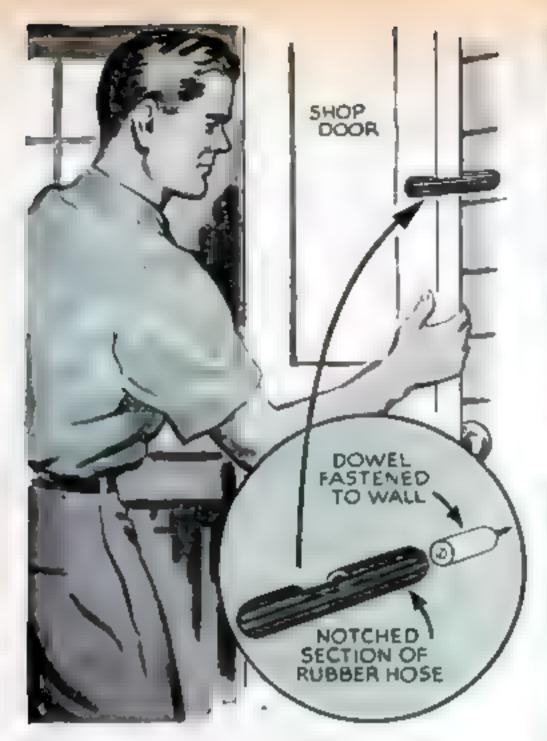
With a cleat screwed bench-hook fashion to one of its bottom edges, a doughboard can't skid all over a kitchen worktable when bread is being kneaded or a pie crust rolled out. The board is used with the cleat bearing against the table edge. Time spent in making selections from double-face phonograph records can be halved if the titles of pieces are marked on the apposite sides as well. Gummed labels make good identification markers.

For maximum safety against shocks and shorts, the "hot" (ungrounded) side of a power line and of radio and appliance plugs should be matched. Locate the hot side with a test lamp having one lead grounded, and mark it with colored tope.





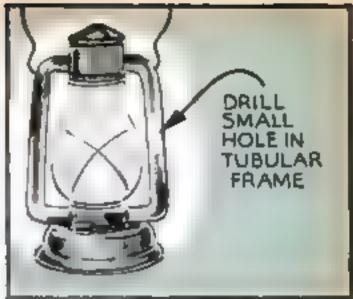
162 SCIENCE



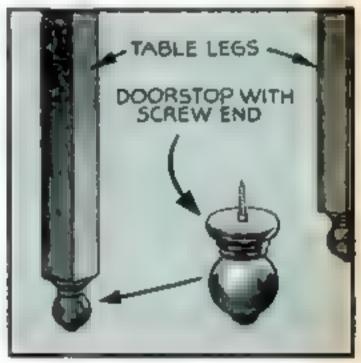
Where appearance isn't important, as in a shop or garage, a length of garden hase notched and comented on a dowel fastened to the wall haids a door open. Cut one end of the hose on a diagonal. Place the dowel so tension will force the hose against the door and also so the hose will act as a stop to prevent slamming.

Storage space can be saved in a cabinet drawer if the knives, forks, and spaces are kept in a tray built to fit the inside width of the drawer. It should slide an rais naised to the two sides.

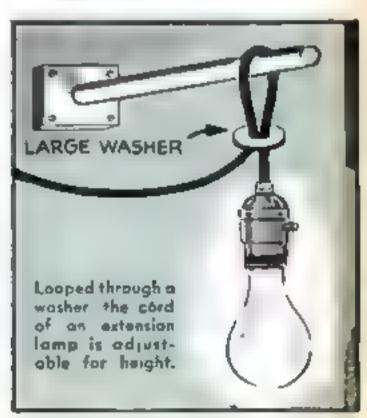


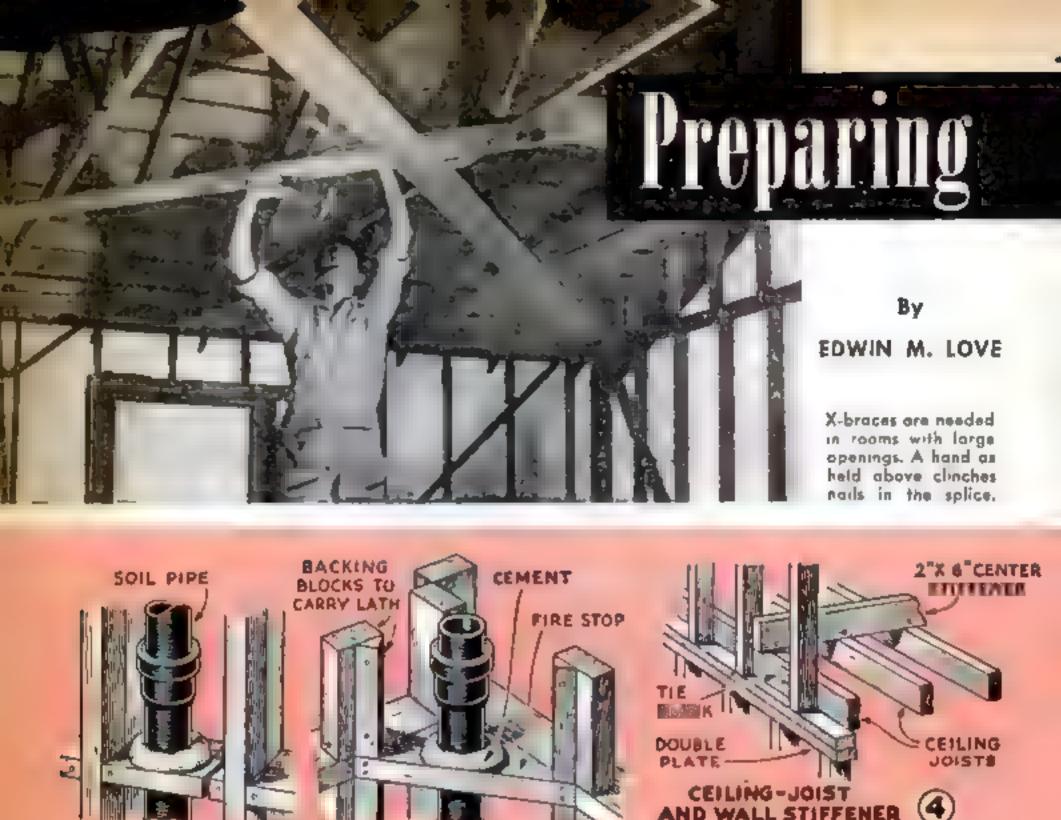


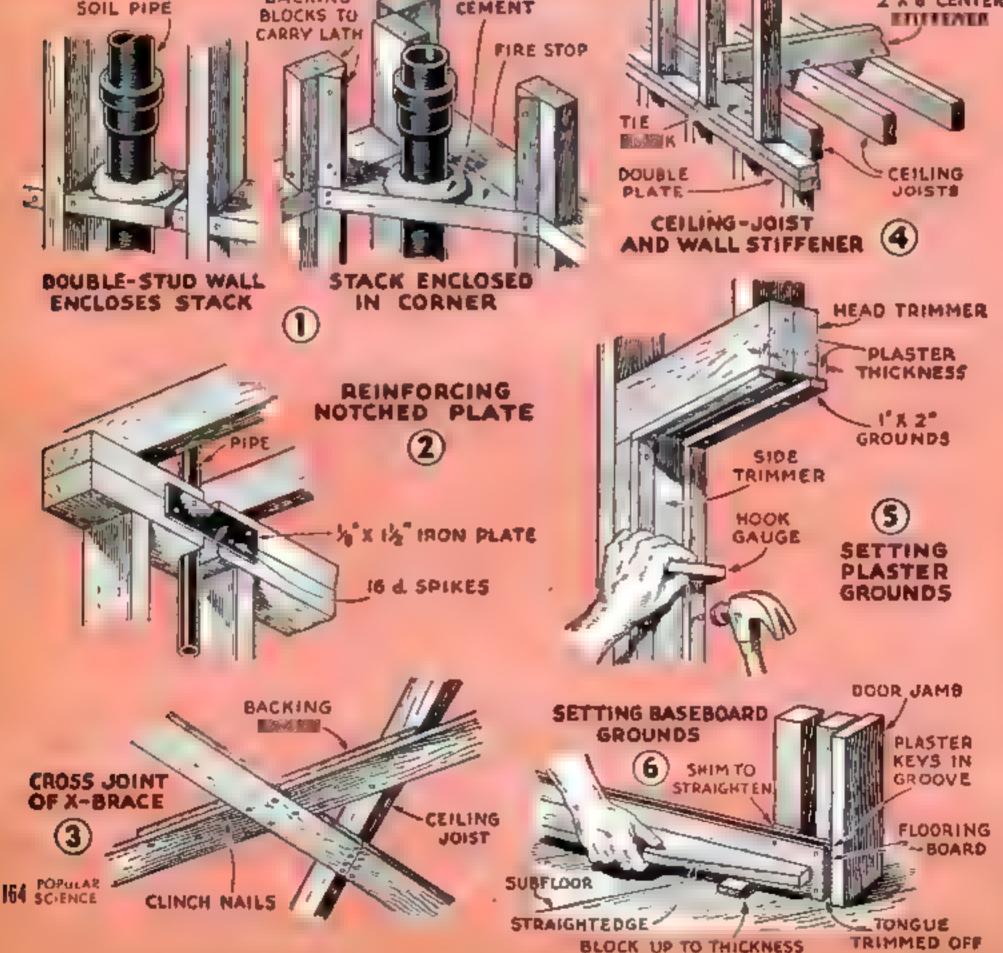
Old hands with lanterns sametimes blow one out by giving it a quick jeck. If you don't like this stunt but still wish to avoid burning your fingers on the chimney, drill a small hale in the frame. Blowing briskly into the hale puts out the flame.



Coffee tobles and children's tables that have become autmoded can sametimes still be useful if provided with longer legs. The simplest way to raise the height is to fasten an ordinary screw-on doorstop on the bottom of each leg.







OF FLOOR

Walls for PLASTER

Local, laws require examination by a building inspector before the walls of a house are plastered or otherwise finished. There are many small details to be completed before he is called. See that fire stops are installed throughout, even in hollow corners, and calk with cement mortar where pipes come through loose holes

Stacks for soil pipes are thicker than ordinary partitions and are usually con-

NAIL PREVENTS

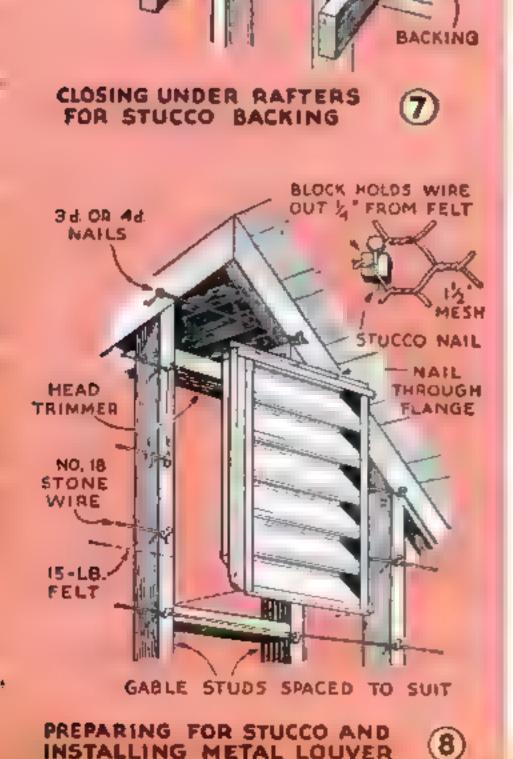
SLIPPING OF BACKING cealed in a wall by doubling the stude in the end of an adjacent closet or by enclosure in the corner of an unimportant room. Both methods are shown in Fig. 1. When the pipe is put in a corner, backing must be provided for carrying the lath both across the corner and on the side walls

Plates weakened by notching for pipes can be strengthened, as in Fig. 2, with a strip of iron drilled and spiked across the notch. In buildings having large openings, such as garages, ordinary bracing must be supplemented by an X-brace like that in Fig. 3 and in the photo on the facing page Boards 1" by 6" carried from corner to corner and spliced on joists are adequate

Gable walls are stiffened several ways. In one of the photos on page 166. I" stock is nailed to a gable stud and a vertical member in a rafter truss. Where ceiling joists are 16" on centers (Fig. 4), they are stiffened with a 2" by 6" spiked on edge. Nail the end of the plank to an end wall

Block window sills near the ends with

Window sills are blacked at the ends, and at the center of wide windows, with 2" wedges driven from inside. The wedges are cut off and covered by the trim apron or by plaster or wallboard.







Gable walls can be given adequate stiffening by a board nailed to a gable stud and to the upright member in a rafter truss. There are other methods, one of them is shown in a drawing on page 164.

and the grooved edge provides a key for the plaster. Trum the tongue and install the board with the grooved edge up. If a finish floor is to be laid, block up the board just high enough to allow the floor boards to go under it snugly.

In most localities a building to be stuccoed is first sheathed,

covered with 15-lb. builder's felt, and enclosed with stucco wire for reinforcing the stucco. A popular wire is 1%" mesh of substantial gauge, but if it cannot be obtained

wedges driven from the inside; if they are wide, block also at the center. Wedges can be cut with a power saw from 2" scraps. If the trim apron will cover the ends, the wedges are cut off flush with the sills; otherwise, cut them flush with the trimmers so they will be hidden by plaster or wallboard. Some carpenters drive spikes through the sills and blocks into the trimmers.

Guides or grounds are required to gauge the thickness of plaster at window and door openings and at the baseboard. Window frames themselves serve as window grounds, as do door jambs when they are set before plastering. Jambs can be set after plastering, if preferred, and false jambs made of rough lumber sized to jamb width can be installed for grounds. In Fig. 5, strips 1" by 2" are used for false jambs to save material. One edge of a jointed strip is gauged for the projection with a block held against a trimmer and plumbed with a straightedge and level as it is nailed. Then the ground is set on the other side, its distance from the first being gauged with a notched block. Laths are sometimes used for grounds, but they are unreliable.

When baseboards are to be set after plastering, grounds also have to be provided as for doors. It is sometimes convenient to set the baseboards first, letting them serve as the grounds, especially when flooring board is used, as in Fig. 6,

In mild climates sheathing is often left off when stucco is used and wire is strung instead for a backing for the builders felt. It is drawn tight around end nails, being strung with 6" spacing.



GG POPULAR

readily, 1" chicken mesh, doubled 2" mesh, or even hardware cloth can be used. In mild climates, sheathing is often left off, and the felt is applied over a backing of wire strung with 6" spacing. This has its advantages since the stucco is not subjected to the strain of shrinking and swelling boards.

Unsheathed buildings must be closed up under the rafters above the walls to provide backing up to the roof. In Fig. 7, a single nail is driven %" back in each rafter to hold the packing pieces flush, and these pieces are cut to fit between rafters and

toensuled in place.

Mark a stick into 6" divisions and transfer the markings to trimmers at the openings and to the corners of the building, resting the stick on a small nail driven into the sill. String 18-gauge stone wire back and forth over nails driven at these points between the openings and the corners, as in Fig. 8, carrying it clear around the building if convenient, and make the wire taut by driving nails into the studs alternately above and below the wire and bending them over and flattening them down. Wire above reach may be left unstrung until felt and mesh are up that high, and then all the work can

proceed after the ladders and scalfolding have been put in place.

Cut convenient lengths of felt, roll loosely, and nail to the studs with large-headed nails. Draw the material up smoothly and trim it along the face of the stucco molding, tucking the edge into the groove. Fit the felt snugly around window sills and bend a flap forward against the underside, Lap the ends of strips about 2".

Metal louvers are set as in Fig. 8. Openings to take them are trimmed in the felt. Nail the louvers through the flanges.

If work is being done in a wind, apply the mesh after each strip or two of felt. Incline the stucco nails to draw the mesh tight. Force ends into molding grooves.

Protect window and door sills from spotting by plaster with scraps of lumber tacked over them temporarily. Sash and outside doors may be hung before plastering and, if so, they can be protected from splattering by muslin tacked over the edges of the frames. Even when sash has not been hung, muslin is useful. In cold weather it permits heating of the interior of the building to prevent freezing of the plaster, and in summer it serves to keep out flies.

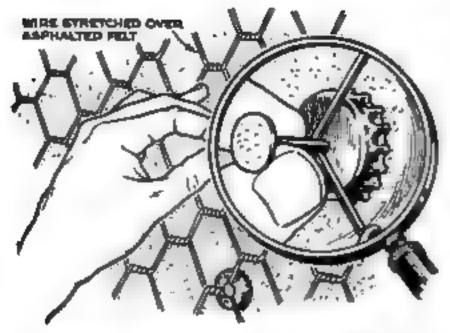
Felt is drawn up smoothly to the stucco molding and trimmed along its face. The end is tucked in the molding groove. Under window sills, the felt is fitted snugly, and a flap is bent forward.

Wire mesh to reinforce the stucco is applied over the felt. It is put on with stucco noils slanted to draw the mesh tight as they are driven home. Force the end into the stucco-molding groove.



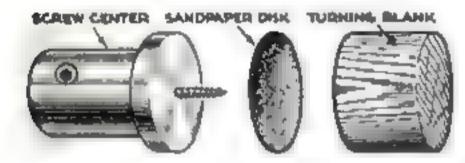


PES. 167



Bottle Caps in Stucco Work

IF FURRING nails aren't available, stucco wire stretched over asphalt felt can be held with old bottle caps and 1%" nails having large heads. Slip a cap under a mesh joint to hold it away from the wall as it is stretched, and nail as shown above.

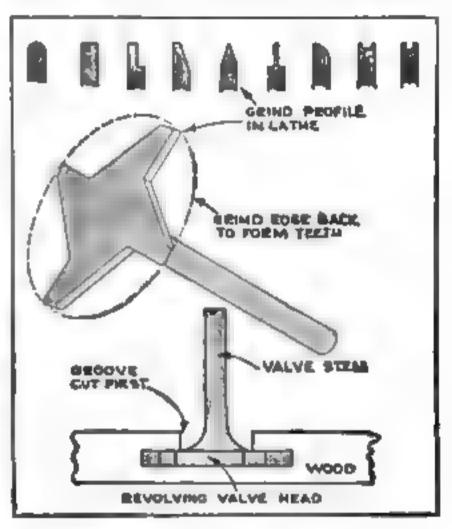


Holding Work on Screw Center

When the screw center is used in the lathe, a wood turning blank can be held more securely if a disk of sandpaper is glued to the center face.—Alfred D. Slater.

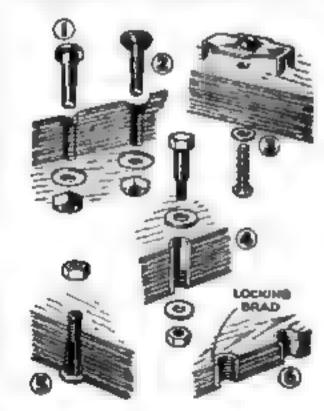
Cutting Head Made from Valve

HIGH-SPEED wood-cutting tools to form T-slots, beading, model molding, model mill-work, picture-frame stock, and the like can be ground from worn auto-engine intake valves that may be picked up as junk. Grind the edge of the head to the desired profile after first cutting the stem to a length that won't affect trueness when the tool is revolved. Use a fast carborundum wheel on the lathe tool post and chuck the valve stem to turn as it is ground.—C. L. MEEHAN.



SPECIAL PLYWOOD FASTENINGS

[WOODWORKING]



While the common carriage bolt (Fig. 1) is often useful with plywood, special fastenings are now available. Figure 2 shows a flush-head bolt having a stepped flare that fits into the countersunk hole. Head fins prevent turning. In Fig. 2, a special roundhead screw meshes with a self-locking nut stamped from sheet steel. The clips, bent upward to fit the thread, are drawn down when the screw is tightened, locking it against vibration, while the claws anchor the nut.

A bolt with a reduced threaded section screwing into a sleeve is shown in Fig. 4. It is locked by a washer and nut. The finned cone of the flush-head bolt in Fig. 5 prevents turning and makes a weathertight and non-distorting fastening

Figure 6 shows two inserts that prevent damage to holes in plywood parts that are often disassembled. One is a threaded sleeve having two semicircular slots for locking with brads, and the other is a grommet fitting into a countersunk hole and crimped on the underside to form a socket for a flush-head screw.

POPULAR SCIENCE MONTHLY SHOP DATA



In designing this new line of spacesaving furniture, Danish architects
O. Molgoard Nielsen and Peter
Hvidt took advantage of the passibilities offered by stacking as well
as discossembling. The six chairs

shown in the photo below take little more space than a single one.

Capable of being knocked down and reassembled quickly without the use of tools, the dining-room table and chairs, left, make a sturdy-looking, handsome ensemble. Two leaves and a bar extension are concealed under the top of the table. Beachwood is used for the set and its companion pieces illustrated on this page.



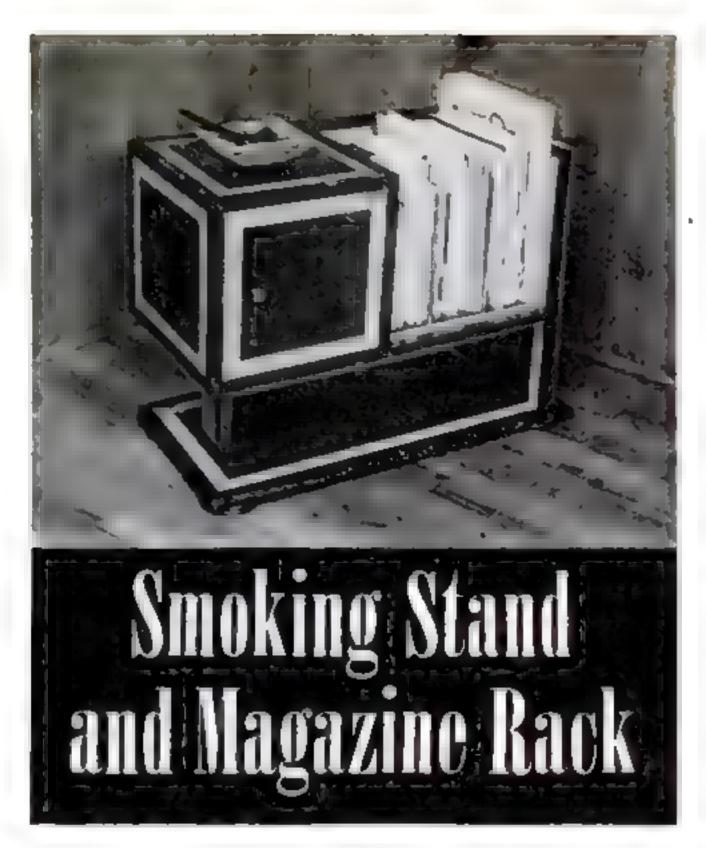
DANISH FURNITURE
Knocks Down for Moving

ESIGNED chiefly for sale in Europe's war-devastated countries, this new line of Danish furniture sacrifices little in visual appeal, Modern in appearance, the simple, functional pieces are well suited to mass production methods. They can be quickly set up or taken apart, thus easing the moving problem on the unsettled continent. Shipping and storing difficulties are correspondingly lessened, since in a knocked-down condition the furniture occupies less than a quarter of its normal volume. Stacking also allows for considerable saving of space.



Units can be used individually or in groups. Counterparts of this single shelf can be added to make an attractive bookcase.

This combination stand holds a full supply of magazines and smoking materials. It is built of walnut with edges of maple and walnut strips in an interesting color contrast that suggests fine inlay work.



By NORBERT ENGELS

SMOKERS who relish a pipe and a good magazine before a fire on a winter night will get double pleasure from this combination smoking stand and magazine rack. It has room for all the current issues of favorite periodicals plus a few of the old stand-bys, and inside the compartment is space for a humidor and a box or two of cigars or a carton of cigarettes.

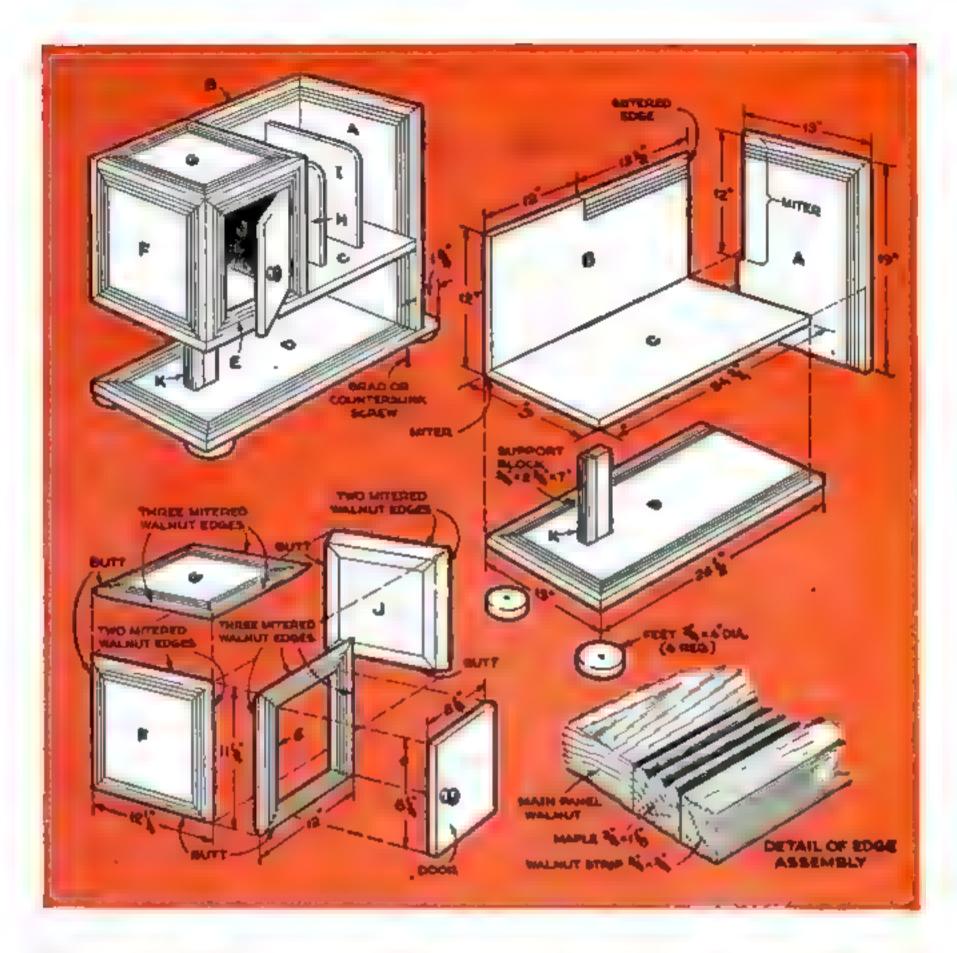
The smoker who is also an adept craftsman will get extra satisfaction by making ing the project in two tones of walnut and maple as shown in the photo, though the stand can as well be built by the novice from solid stock or "plywood with one good hardwood face and still be a handsome piece. As illustrated, the light maple strip is fluted on a shaper, but it could be used plain instead and still show a good contrast with the walnut centerpieces and walnut edges.

Clue up the two-toned boards with mi-

tered corners, as indicated in the drawings, using a good waterproof plastic resin glue and a few countersunk brads or finishing nails to prevent slippage when clamping. Put together only a few joints at a time for easier handling, and fill all exposed nail holes with colored plastic composition wood. Square joints and good glue are imperative for a workmanlike job.

Note that D is edged only on three sides and A on two. In addition, the back edge of A is beveled 45 deg. for 12" from the top to form a miter joint with the bevel of B. The stripping on B is confined to a 1%" by 13%" section notched in the right-hand upper edge. C is joined to B with a miter joint, but is butted against A. The support block is a piece faced on one edge with maple and bradded and glued to C and D.

Maple strips are glued all around the walnut panel for F and J, the sides of the compartment, but beveled walnut strips are



glued to the maple at only the top and front. These pieces are butt-jointed to the back, and for the outer one, F, this butt provides the walnut edging as does C at its bottom

The cabinet top, G, is built up with maple strips on four edges and beveled walnut on all but the back. These beveled walnut strips form miter joints with the two sides and the front, E, while the walnut butt joint of B provides a walnut strip at the back.

Piece E, as can be seen, is merely a frame made up of four maple strips edged at the top and sides with 45-deg, beveled walnut. The door, a solid panel of walnut, forms the panel inside the frame when it is closed, and the edge of piece C, to which the frame is butt-jointed, provides a walnut strip for the bottom edge. A knob may be turned for the door from a scrap of maple, or a suitable one

Ŋ,

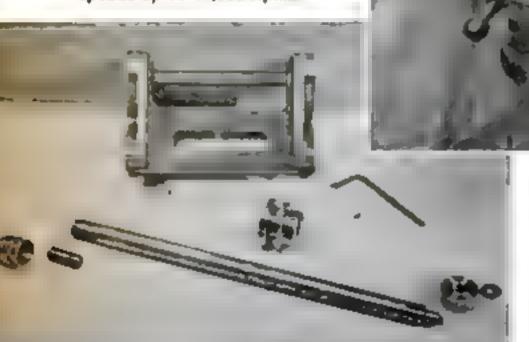
may be purchased ready made. Small hinges are mortised into the frame and door.

Two partitions are sawed from plywood, one corner is rounded, and they are glued in place and bradded from underneath and from the back. Since they will not show while holding magazines, the quality of the face veneers is unimportant, but they may be stained walnut.

The four feet may be plain wooden disks screwed to the bottom of piece D with countersunk flathead wood screws. They may be either walnut or maple to suit taste.

After the stand has been thoroughly cleaned and sanded, a conventional clear-varnish finish will best show the natural maple and walnut contrast. Follow with two coats of paste wax rubbed in with fine steel wool and polished with soft cloth.

Traversed by the control knob, the grinding wheel is fed across the work in the lathe. A long cord belt running to a small mater averhead permits spindle travel up to about 2". A 6" pulley on a 1,750-r.p.m. mater will turn the spindle pulley at speeds up to 14,000 r.p.m.



Low-Cost Tool-Post Grinder

FOR finish-grinding, every lathe owner wants a tool-post grinder. This simplified one, built mostly from scrap materials, has often performed as well or better than conventional grinding outfits.

The spindle is a %" steel rod about 7%" long. Use drill rod or other stock ground to uniform diameter and, if necessary, lap it to rotate freely in sleeve bearings with no play. Hold the shaft in a true-running chuck and

thread one end X"-24 to receive the conical cap shown in Fig. 1. Drill a X" hole X" deep in the threaded end of the spindle and counterbore this to a depth of X" with a X" diameter counterbore or reground drill having a 90-deg. included angle between cutting edges.

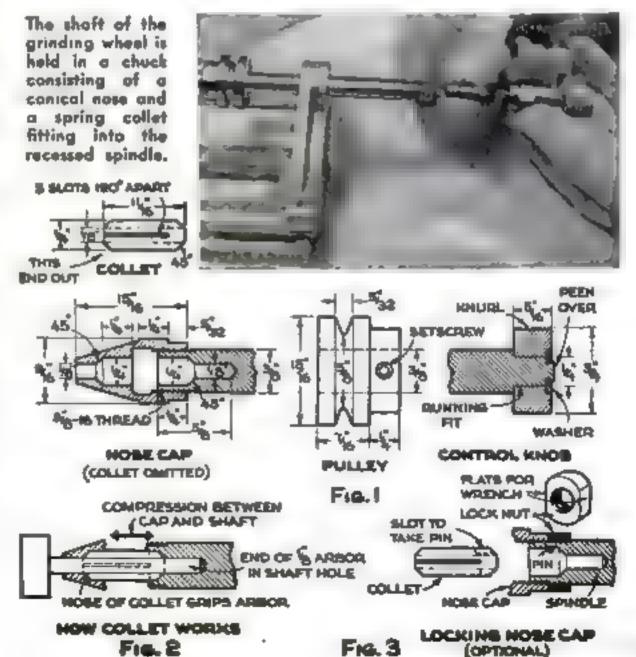
A flat is filed \$%" from the threaded end of the spindle for the pulley setscrew. Turn down the unthreaded end of the shaft to %" diameter for a distance of %", and reduce about 1/16" of the end to %" diameter. File two flats %" long on the shaft adjacent to take a wrench

Machine and knurl a

172 SCIENCE

control knob X" in diameter. Drill a X" hole through and recess it to receive loosely a washer having a X" hole. This washer and the knob are held on the shaft by riveting over the tip of the stub. The knob must turn freely. Machine the pulley from steel and tap for a 3/16" setscrew. Polish the groove.

To make the conical nose cap, first drill a %" hole all the way through, counterbore this with the 90-deg. %" bit until only %" of the



smaller hole remains at the nose, and finally enlarge the counterbored hole to 5/16" for a depth of X" so it can be threaded to fit the spindle. Cut flats to fit a wrench.

This nose cap, when screwed down, compresses a tool-steel collet (Fig. 2) around the %" shank of the grinding wheel. Machine both ends of the collet to 45 deg. Inside and outside diameters and the angular surfaces must be concentric. Saw three slots 120 deg. apart in one end for three fifths of its length. Harden and temper the cap and collet.

A lock nut that can be tightened against the nose cap, as in Fig. 3, would prevent unscrewing in use, and a pm to keep the collet from turning could be installed after

the spindle is drilled but before it is threaded. Slot the collet to shp over the pin.

The frame and bearings were made from the frame of an old radio condenser and bolted to a steel plate with a stud to fit the hole in the lathe cross slide. Centerlines of the grinder and lathe spindles must be in the same plane. Use felt washers on both sides of the bearings to keep out grit, and loop wool yarn around them and the shaft. Apply oil to the yarn.

To use the grinder, adjust the spindle to the proper angle with the work and feed the wheel by moving the shaft lengthwise by the knurled knob. Be sure to wear protective goggles and cover the lathe ways.

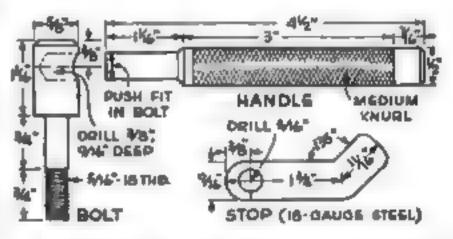
Quarter Turn of Fixed Wrench Locks Lathe Carriage on Ways

WRENCHES used on a lathe have a habit of turning up almost any place but where you want them at the moment. This one, which in reality is a new lathe-carriage lock bolt equipped with its own permanent handle, can never try your temper by straying just

when you are in a hurry.

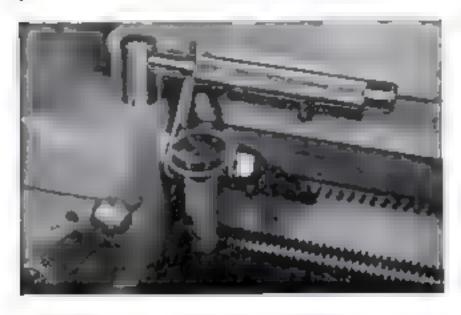
Turn the holt from cold-rolled steel with a thread to fit the original carriage lock nut, and knurl and turn the handle also from cold-rolled steel. Then, before drilling the bolt head for the handle, engage the bolt in the nut, tighten it on the carriage, and mark the hole position so the handle will be at right angles to the lathe bed when the carriage is locked. Drill the hole slightly undersize and grind the end of the handle to a press fit with the tool-post grinder. When the bolt wears, shims under the bolt head will be necessary to retain the proper handle position.

To keep the handle from swinging against or in front of the tailstock when unlocked, I made a stop of 18-gauge steel. It is clamped between the threading dial indicator and carriage. I also inserted a .075" spacer so the split nut would engage properly in relation to the witness mark on the dial indicator.-JOHN A. BATES.

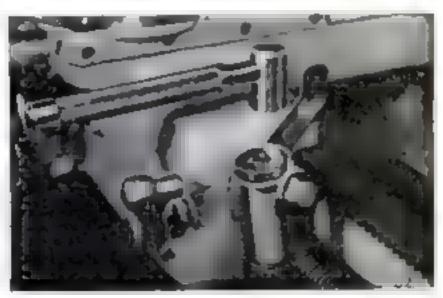


All parts needed for the lathe-carriage lock bolt are shown here, together with finished dimensions.

In the unlocked position, the bolt handle swings against a stop so placed that it will not obstruct your view of the threading dial Indicator.



Because of its length, the handle must be pressed into the hole in the bolt head when the bolt is in place, since the carriage limits its swing.







ONE problem that has engaged machinists since the first taper was turned is resetting the tailstock center for accurate straight turning after it has been set over for a taper. The taper attachment is the ultimate answer, but those who do not have this accessory may find a solution in the two gadgets shown here.

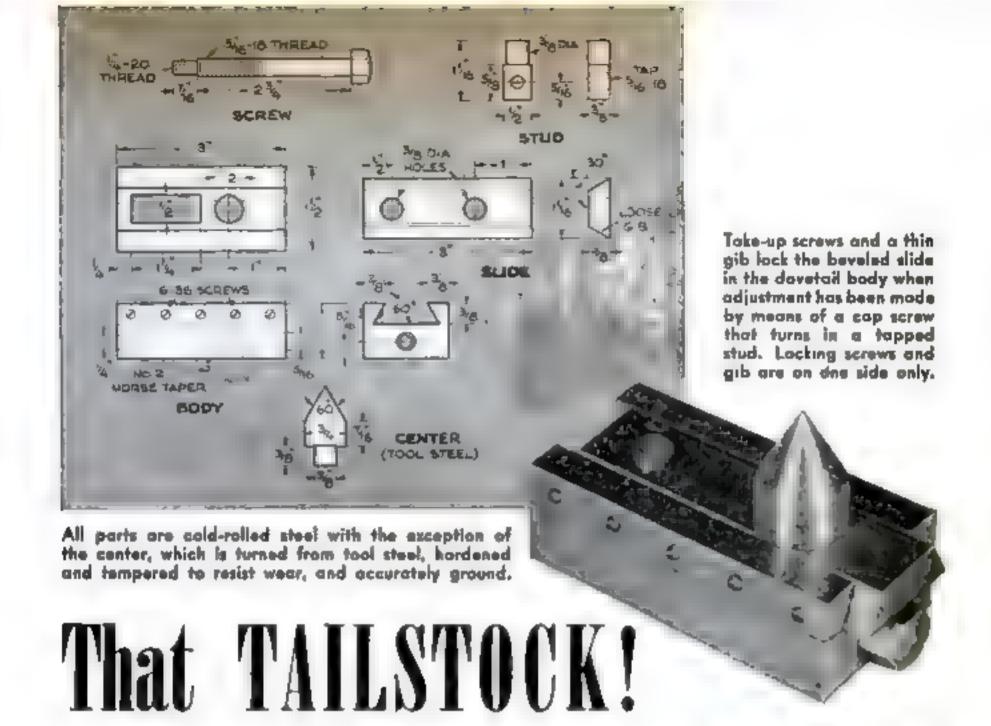
Both employ the same principle of an adjustable sliding center for the tailstock. Either can be set and used for a given taper, removed from the lathe while straight turn-

Realigning the dead center after taper turning is a really tough job. Either of these gadgets will save you that trouble.

ing is being done, and returned for working on the same taper without resetting. The one shown above and at right is adjustable up to 1" on either side of center and is made in the lathe and milling attachment; the other, on page 176, has a range of only %", but it can be made in the lathe alone. Both are formed from cold-rolled steel, except for the center point, which should be tool steel hardened and ground to withstand the wear of off-center turning.

C. W. Woodson built the taper center with a dovetail body and a slide. Five hardened take-up screws and a thin gib lock the device at the desired adjustment and compensate for wear. Mill the dovetail in the body first; then drill lengthwise for the adjusting screw and through the face for a taper shank fitting in the tailstock. The slot in which the stud on the bottom of the slide rides is shaped by drilling overlapping holes and filing. Drill and tap the holes for the take-up screws.

Mill the bevels on the slide, making allow-



ance for the gib, and drill for the stud and hardened center. Turn the stud from bar stock previously drilled and tapped on the square end for the adjusting screw, which may be made up from an ordinary cap screw. A %"-20 nut is put on after the screw is inserted, and the end is headed over so the nut can't come off.

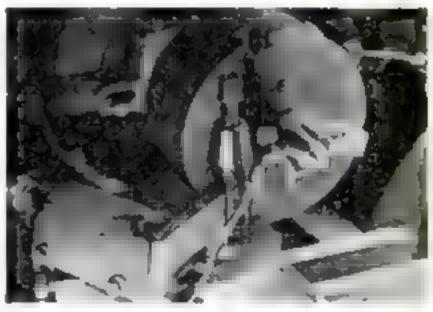
The center point is turned from tool-steel bar stock while held in the three-jaw chuck, the angle being cut by setting the compound rest over 30 deg. Turn the shank at the same chucking to assure concentrative with the point. Harden and temper the point, grind accurately, and drive in tightly after setting the point in a centerdrilled hole or

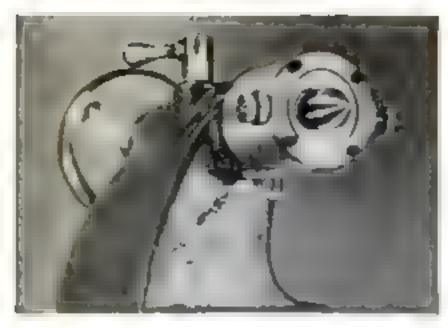
Their shorks driven into holes in the slide, the center point and stud project from apposite faces.





Drilled and tapped bar stock is chucked (above), and a shank is turned to complete the stud. The center is turned, as below, from tool steel held for enough out in the three-jaw chuck for a shank to be turned concentric at the same chucking.





Another tailstock taper gadget can be adjusted by thumbscrews pressing on a sliding center, which is locked in position when the cover is screwed down.

On a lead block so as to avoid marring it.

A Morse-taper shank taken from a broken drill makes a good shank for insertion in the tailstock. Turn the outboard end to a shrink fit, heat the body to expand the hole, and drive it on.

Jack Mellinger designed the adjustablecenter device shown on this page. It is intended to be clamped on a tailstock ram I" in diameter and is keyed to the ram for a tight fit and to prevent turning.

Turn the two-piece body and cut the key-



A thumbscrow through the underside engages a key in twin keyways in the body and the tailstock ram, on which the taper center is mounted for use.

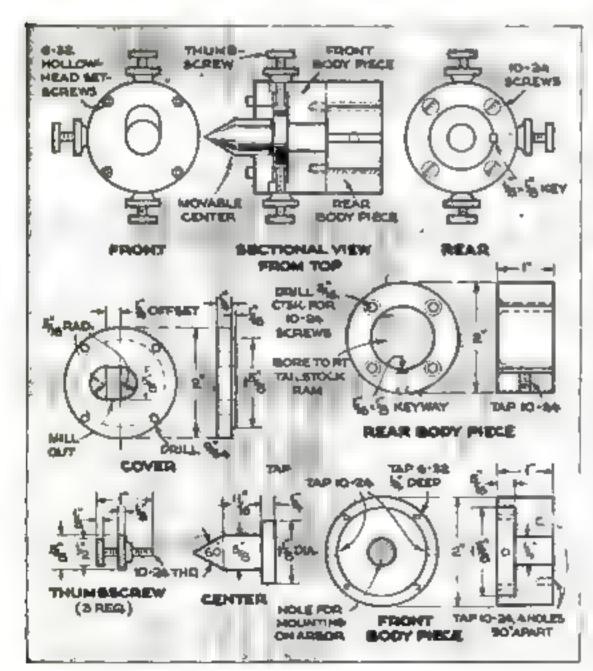
way in the rear section by hand filing, taking care to get a tight fit for the key at all points and a close match with the keyway in the ram. Make three thumbscrews, drill and tap the body to take them, and drill and tap for the four 10-24 machine screws.

The cover is turned next and drilled at the center several thousandths under \$". Holes are then drilled and tapped for the 6-32 hollow-head setscrews. Assemble, mount on an arbor, and smooth up with a light cut on the outside; then mount on the tailstock ram,

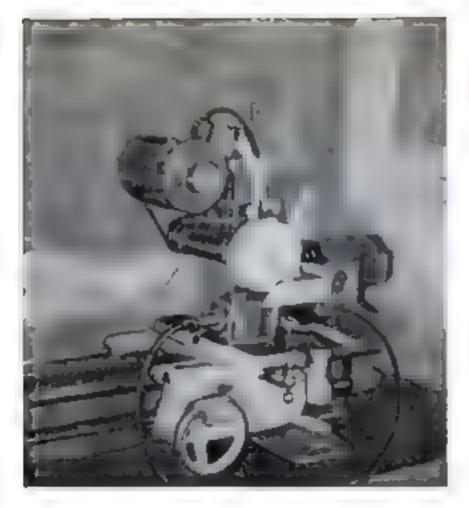
check all fits, tighten the bottom thumbscrew, and score the cover horizontally for the slot. This is either cut with the cover mounted in the milling attachment, or made by filing out overlapping holes by hand. If the slot is hand-filed, great care must be taken to keep the two straight edges truly parallel to each other.

Turn the center from tool steel, making the shank a close fit in the slot, and harden and grind. Adjusting the thumb-screws at the sides moves the center to the desired position, where it is clamped by tightening the setscrews in the cover. The center point may be moved toward either the front or back by reversing the position of the cover.

Two pieces are turned to make the body and held tagether by machine screws. The keyway is cut in the rear section only. These and the other parts are shown in the drawing at left.



178 SCIENCY





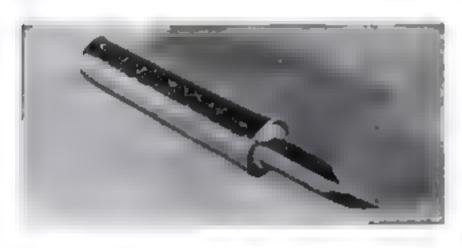
GAUGES FROM DOWEL PINS. Since hardened dowel pins are manufactured to close tolerances, they will serve as gauges if fitted with handles made from hexagon brass or steel bar stock. Sweat-solder the pin into a hole drilled in the end of the handle after nicking the end of the pin in several places on a grinding wheel to insure a good soldering job. The moderate heating required for soldering will not affect the hardness of the pins. Stamp the size of each gauge on the handle.—J. C. MAGEE.

LATHE AS SURFACE GRINDER. The attachment above makes it possible to use any small lathe as a surface grinder. It consists of a pedestal clamped to the lathe bed on which the compound slide, removed from the cross-feed slide, carries a homemade tool post grinder (PSM, Aug. '41, p. 170). This gives vertical adjustment of the grinder.

In place of the compound slide, a magnetic chuck is mounted on the cross-feed slide. It was made from the field coil of a radio loudspeaker. The mount of the chuck as well as its work face were both trued with the grinder itself right on the lathe. The 6-volt power supply is an auto generator and a x-hp. motor.—R. B. Goodell.

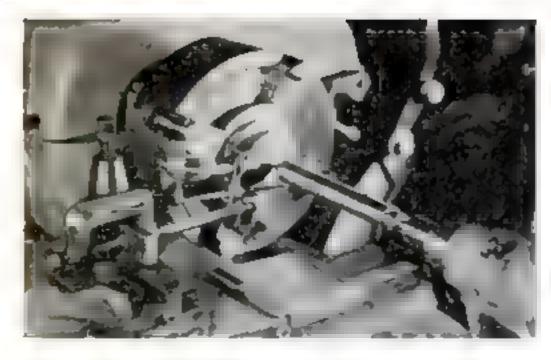


TAPE PROTECTS BEARINGS. When bearings are stored for future use, wash them in kerosene or other grease solvent, oil lightly, and wrap in cellulose adhesive type to seal against moisture. When a bearing is needed, the transparent tape permits examination without unwrapping.—Will Thomas.



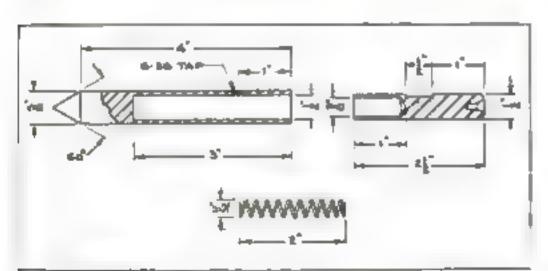
DRIVING CENTER. A driving center for light work that cannot be gripped by a lathe dog can be made from a broken taper-shank drill. Turn down its outboard end and bring this to a sharp point by grinding three evenly spaced flats. Lightly driven into center-drilled work, the tool gives sufficient driving force for light cuts.





LATHE CENTER TESTER. Used with a dial indicator, this center tester will enable you to center accurately a point or hole in work mounted on the faceplate or in a four-jaw chuck. With the tester point resting in a punch mark or hole and the other end supported by the tailstock center, the dial indicator is brought to bear on the barrel. The work then may be adjusted to run dead true.

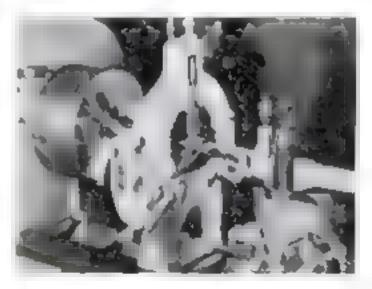
Machine the barrel from tool steel, turning it to a 60-deg, point on one end and accurately boring the other for a sliding tailstock bar. Turn the tailstock bar to a snug sliding fit in the barrel, drill a center hole in one end, and bore the other for a coil spring. Assemble the parts, tighten the setscrew to retain the sliding bar, and the tool is ready for use. For greatest accuracy, prevent the tester from turning while work is being indicated.—C. W. Woodson.



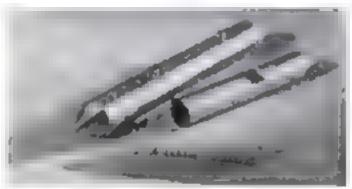
CABINET FOR LATHE TOOLS. How many times have you been forced to root around and waste good working time trying to find a drill, lathe center, or other small item that you have mislaid? My solution was the lathe accessories cabinet shown in this photo. The six built-in drawers help me keep tab on the small articles. Dowels and a rack provide a special place for each of the larger ones and make them easier to find.—John G, Lownsberg.



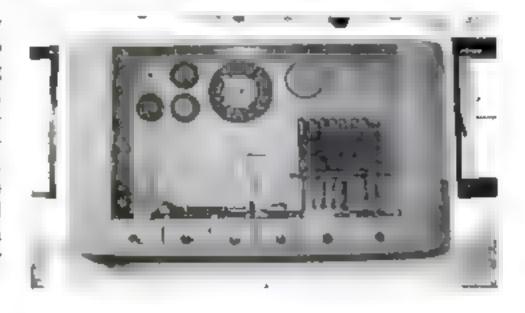
Shown in use with a dial indicator at the left, this center tester must be carefully machined for accurate work. Turn the barrel to a 60-deg, point.

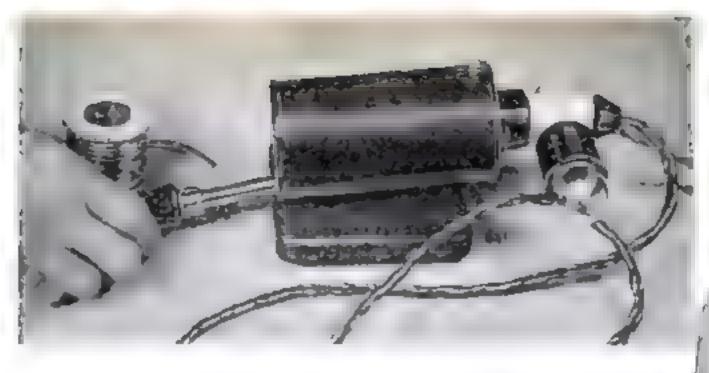


Support the barrel in the steady rest and bare it to a depth of 3" for the sliding tailstock bar. Tap the barrel 6-36 for a setscrew I" from this end.



Here are the three parts of the tester. The coil spring provides the slight tension needed when the device is in use. The tester itself should not be allowed to rotate with the work.





The complete stand, at left, turns the current on and off to regulate heat. It is built around the light-blinker thermostat, below.

Soldering-Iron Thermostat

CONTROLS HEAT AUTOMATICALLY

OFTEN the electrical or radio worker will leave his soldering iron connected for long periods simply to have it ready for use when needed. Yet allowing an iron to "soak" in its own heat this way isn't good practice; aside from the current waste, it burns and pits the tip and makes frequent retinning necessary.

This thermostatically controlled stand climinates these difficulties. As long as the iron is in the stand, temperature is held to a level that will permit almost instant use but still retard pitting; when the iron is removed, it gets continuous current. The heart of the gadget is a little thermostatic element taken from a dime-store light flasher or blinker.

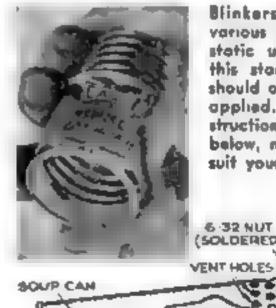
Blinkers come in several styles. Most suitable for this purpose is one constructed on a porcelain base, in which increasing heat opens the circuit. Remove the fine wire that is wound around the bimetal strip, and hold the unit over a flame to see whether heat opens or closes the circuit. If the element is of the latter type, reverse the bimetal piece, bending it so that it contacts the stationary strip when no heat is applied. Next arrange an insulated adjusting screw, as shown in the drawing, to permit you to vary the position of the stationary contact.

The stand employs a soup can as the main housing, a smaller can to position the soldering up below the thermostat, and a square tin hd as a base. Give the assembly a coat of black stove enamel.

Connections to the thermostat are made

with ashestos-insulated wire, and a conventional electric outlet is fastened to the bottom of the housing can. One mounting screw holds the thermostat and outlet on either side of the tin. Punch several vent holes in the can above the blinker element.

Adjust the fixed contact till the unit turns itself on and off just often enough to keep the temperature of the tip above the melting point of solder. A neon lamp used in parallel with the fron will provide a visual check on both the adjustment and operation of the stand.—Gilbert Sonbeach



Blinkers are made with various types of thermastatic units. For use in this stand, the contacts should open when heat is applied. Wiring and construction details, shown below, may be varied to suit your materials.

6- 32 ADJUSTING

PHOTO IDEAS and EQUIPMENT

CAMERA STAND. A studio stand with one support tube, developed and being marketed by Richard A. Meek, of Richmond, Ind., provides for a wide range of hard-to-get angle shots. A large ball and socket joint gives a wide range of camera angles, and a counterbalancing system makes it possible to handle cumbersome cameras with ease. A minimum of floor interference is obtained by using only two feet on the upright tube. Light in weight, the stand is easily moved.

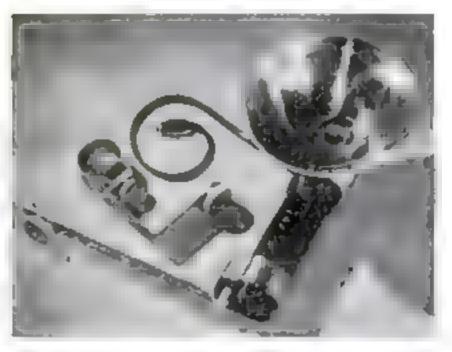


NEW FLASH GUN. Fitting Kodaks with built-in synchronization, a flash gun just announced by the Eastman Company for amateur picture taking has a 5" aluminum reflector, a socket for either Class F or Class M midget lamps, and an extension socket.



PREFABRICATED DARKROOMS, complete except for purely photographic apparatus, are offered by the Photo Engineering Company, of Hollywood. Delivered knocked down, the parts can be assembled by one man in about 6 hours. In the view above, one wall has been removed.

Occupying a floor space 8' square and standing 7' 8" high, the darkroom is especially intended for garage or basement installation. A unit is fitted with plumbing, shelves, drying racks, a work table, an air filter, an 8' stainless-steel sink, and a wash tank. The built-in wiring terminates in one piece of BX cable long enough to reach an outlet, and garden hose may be used to supply water and carry away waste, making it unnecessary to call an electrician or plumber unless permanent connections are desired. The darkroom sells for approximately \$500.





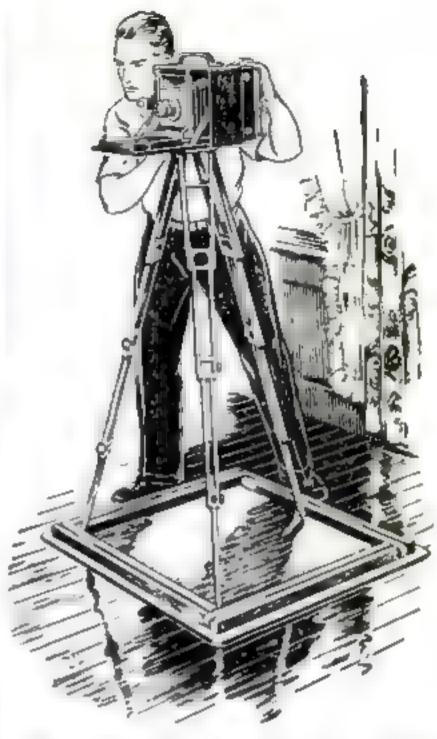
BABY SPOTS often cannot be used at acute angles because the frame or base restrict movement. This can be largely overcome by attaching a universal-joint tripod head to your lamp stand and mounting the lamp on this, as seen above.—Thank L. Bierwert.

PHOTO SLIDE RULE. A device produced by the Lawrence Engineering Service, of Peru, Ind., makes it possible to determine quickly the lens aperture and correct distance in feet for various photoflash lamps. It also may be used to find the correct lens opening and shutter speed for color photography.



* Iming shallow cardboard boxes with double thicknesses of waxed paper. Press the paper in but don't make any sharp creases.





POLISHED FLOORS are a dangerous place to use a tripod unless it is equipped with braces and rubber feet. If these are not available, the difficulty may be overcome by folding up a card table, inverting it on the floor, and mounting the tripod on it, as indicated in the sketch above.—G. D. HENDRICKSON.



NEGATIVE DÜSTER. An air brush to dust your negatives and lenses is right at hand if you have an old atomizer or other device with a rubber bulb. If desired, the tubing extension of the atomizer can be removed and the bulb used alone.—HERMAN KLEIN.

PLYWOOD CAMERA Does

By Walter E. Burton

ALMOST unlimited are the uses to which this photographic copying outfit can be put. In the office, shop, and home, it can make exact, low-cost reproductions of important documents, letters, checks, data sheets, drawings, instruction sheets, recipes, blank forms, and similar "flat work," and it can be employed for photographing small objects. The work can be done directly on paper or on film.

Any of several sensitized materials can be used. Process film, commercial photographic recording paper, contrasty glossy enlarging paper, and other papers work successfully.

The camera illustrated was designed to take sheets of paper up to 6h" by 8h". By varying the dimensions of the holder, such standard sizes as 5" by 7" and 5" by 8" can be accommodated; and by increasing the size of the camera box, larger sizes such as 8" by 10" can be used.

As with any camera, the lens is the most important part. One of approximately 7" focal length is required for a box of the dimensions specified, and it should be, if possible, a good anastigmatic camera lens. If the focus is not around 7", you can use supplementary lenses to increase or decrease it.

A fairly satisfactory substitute for a regular camera lens can be assembled from one or two achromatic lenses, which consist of two lens elements cemented together. One achromat of about 7" focal length, used with an aperture stop, is capable of producing a reasonably sharp image. Two of about 15" focal length, mounted with an aperture disk between them and separated by %" or so, have a combined focus of about 7%" and produce images showing less aberration than a single lens.

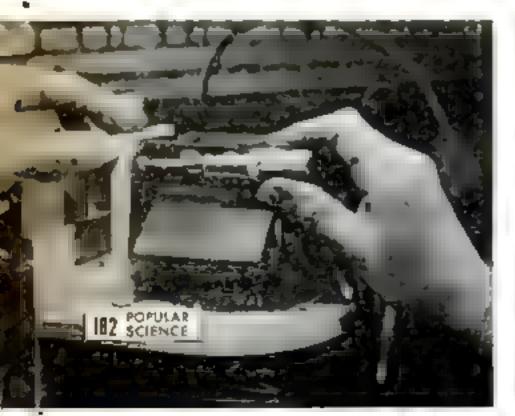
Since there is a shutter inside the box, the lens can be in a simple barrel mount. The aperture may be in a black cardboard disk. Try various sizes, starting with a k" hole. The smaller the hole, the sharper the image will be, but the exposure required is correspondingly longer

Be sure the lens covers a large enough area, but remember you will work closer to the subject than you would in ordinary photography and the sensitized material will be farther away. Under these conditions, a lens covers a much larger film or paper area than that for which it was designed. In using the camera for making copies the exact size of the original, locate the lens at twice its focal length from both the film or paper and the subject—14" for a 7" lens.

The camera box, built of %" plywood, is 65" deep and 9%" by 9%" in the other outside dimensions. Attach a front panel with a centered 5" diameter opening. Along the top and bottom and one side of the open back, brad and glue %" by 1%" composition-board strips, projecting %" at the rear to take the paper holder. Make all joints lightlight, gluing strips of wood or cloth along them if necessary, and apply dull-black paint to

Brackets screwed to the lens-board assembly hold the image-reversing mirror at a 45-deg, angle to the lens. A suitable prism could also be used.

Operated by a rod bent at one end for a handle, a shutter of tin-can stock is turned up to shut out light and let down to make an exposure.







sides, and over each attach
a second strip X" wider than the first to
form channels for the paper. The open end
is toward that end of the holder that will

project at the side of the camera.

thin-metal strips on three

Put a three-sided wood frame around the metal strips, grooving the inside edge %" deep for a dark slide, which may be a sheet of .032" aluminum. Allow %" extra length for a riveted split-dowel handle.

Build up a hinged slide guide of velvet-covered composition board and aluminum or other metal for the open end of the paper holder. Cover the inside surface of the composition-board strip with velvet cut to reach down over the edge and under the base. Glued down, this strip of velvet becomes a hinge so the slide guide can be lifted up for insertion of paper. Spacers and

a top strip, all covered with velvet, complete the guide. Two short pins made from cutoff nails engage the underside to relieve strain on the velvet hinge. Paint the inner surfaces of the holder dull black. The slide need not be painted. Two L-shaped metal clips on the bottom of the camera and a turn button on a block on the top keep the holder in place. Several holders can be made, one for each size paper or film.

Mount ground glass in a frame the size of the paper holder for use as a focusing screen. Have the ground side toward the lens, located in the same plane as the paper or film. Window glass can be ground for use with a paste of water and No. 120 aluminum oxide grains. Rub with a flat piece of metal

The lens is mounted in a board screwed to a sliding panel for focusing. Bent metal strips on the sliding panel ride a rectangular focusing track attached to the front of the camera with angle brackets. The sliding piece is moved by means of a lever screwed to the stationary track and to a wood disk, which in turn is screwed to the sliding piece through a %" slot. Operation of the disk link is smooth, yet enough friction is produced by the large area to help lock the lens in the desired position. Friction can be varied by tightening or loosening the screw engaging the sliding panel.

To reverse the image so it will reproduce naturally, mount an optically flat mirror or large right-angle prism in front of the lens on brackets attached to the lens board or sliding piece. A bellows can be taken from an old camera or enlarger, or one can be made from stiff paper, fabric, or leather,

using a camera bellows as a pattern. Frame the open ends with wood and screw them to the lens board and the front of the camera.

Exposure may be controlled with a simple shutter consisting of a rod run through the box to work a leaf of tin-can material that closes or opens the circular hole in the front panel. The rod may go through 1" behind and X" below the opening so the shutter will tilt against the front when closed and rest on the bottom when open. Bend one end for a handle. Paint the leaf and rod dull black. Exposures, a matter of seconds, may be timed with a watch. If you do not wish to make a shutter, exposures may be controlled by turning the lights on and off.

Mount the camera above a working table or base at a height sufficient for the desired range of reproductions. While the lens is twice its focal length from the subject for an exact-size reproduction, the distance must be increased for smaller copies. The camera shown is on a 14" high platform mounted on a 1" by 10" by 28" base.

A horizontal easel for supporting the subject may be made adjustable for height on four parallel pivoted arms and locked by tightening the screws in the ends of the arms. It is separate from the base and is centered simply by moving until the image is centered on the ground glass.

Lighting may be with one or two spotlights placed to illuminate the subject at an angle that won't shine light directly into the lens. Or two photofloods in clamp-on reflectors may be attached to the platform uprights. Lighting should be even and can best be determined by test. Length of exposure is best established initially also by trial, END

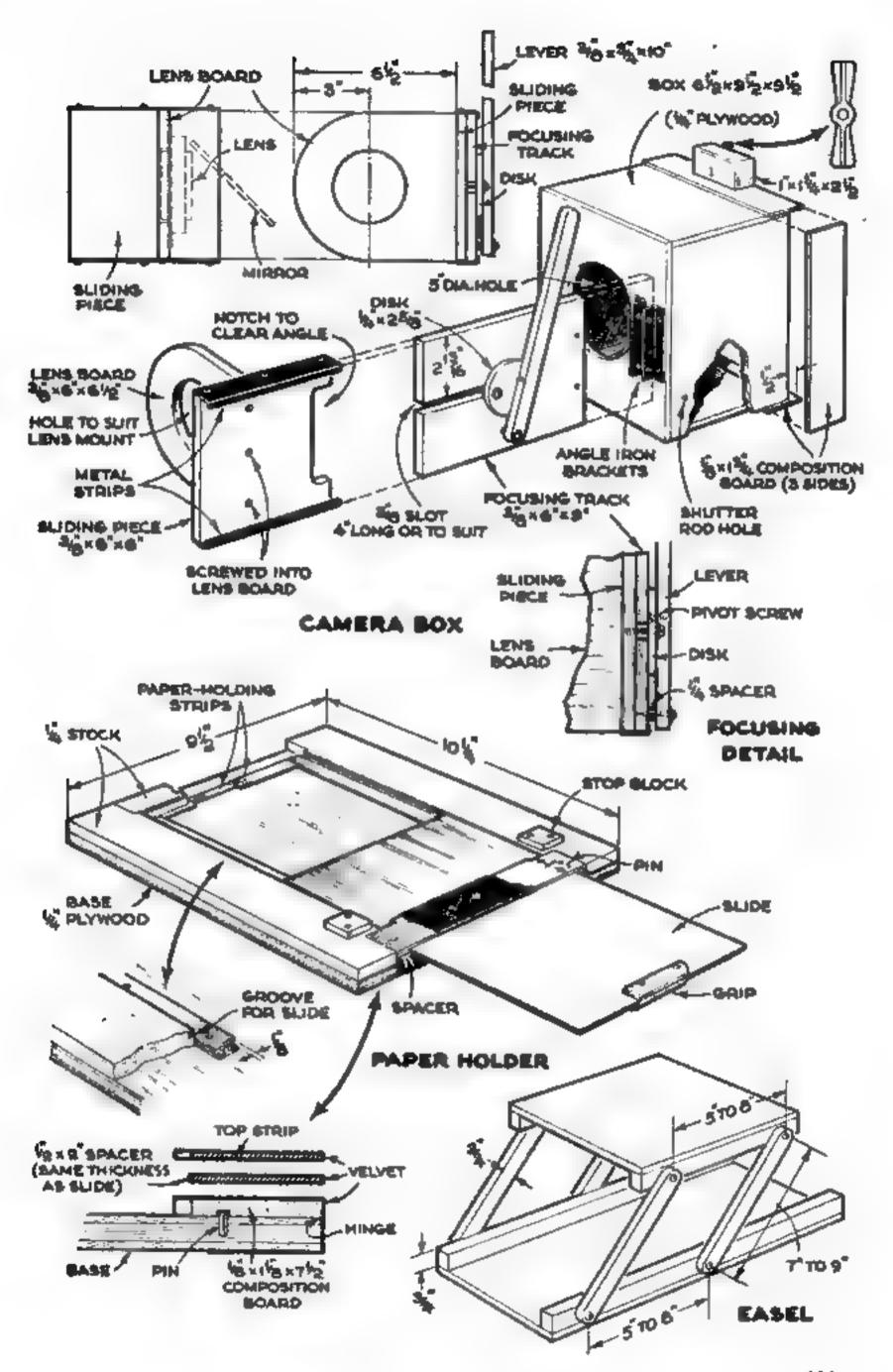
Guide lines on the paper holder center the area to be covered by the paper. Strips of this metal are attached at three sides.

At the open end of the paper holder is a slotted and hinged entrance guide for a dark slide that protects the sensitized paper. Velvet covers the guide.





184 SCIENCE



Call That SPADE? a SPADE?

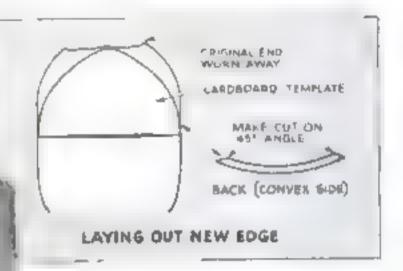
If you can't, here's how to fix it

By HAROLD P. STRAND



First step in remodeling your warnout spade is to clamp it securely to the workbench and mark the autlines of a new edge. Use a template as shown in the drawing at right.

With a 24- or 32-tooth hocksow, cut away the metal outside the scribed line. Follow the line closely, and hold the saw at a 45-deg, angle to produce a sharp leading edge.



After sawing, smooth and true the edge with a flat bastard file, holding the file at the same angle as the saw. Take care not to blunt the edge. Finish with a finer file if necessary.









Trim the new grip to a snug fit between the yokes and slip a soft-steel rod through the center hole, allowing 1/16" extra at each end. With washers in place, peen over the tips to form tight joints.

If the hondie has a split in the wide part as well as in the grip, remove the rod, cut away the broken wood, and allow same glue to run in. Then clamp the parts, drill, and countersink a flathead screw.

A new hordwood grip may be turned in a lathe or made from dowel. Drill a "hole for the new rod.

FILE OFF HEAD CRIGHNAL ONZ-TURNED TO REMOVE ROO PIECE NAMPLE MANO GRAN SAW HERE AFTER DUR DRIVONAF SPLIT R VE IED 170 SPLIT DIMED そうこり SCAEW REPAIRING HANDLE

When all the repairs have been made, clean up metal and wood with steel wool and sandpaper; then use point and varnish.

TEN YEARS is a long time in the life of a spade. So long, in fact, that the tired antique pictured on the facing page had a toe hold on the junk heap before it was brought back to life by a complete overhauling.

The photos on these pages show the remedies for the two most common ailments of old spades, a blunted blade and a cracked handle. Before attempting the repairs, make sure that the handle is not too badly damaged (in which case a new handle will be needed) and that the metal part has not rusted through. You'll be surprised at how much easier your garden chores become when you use a spade with a clean, sharp point.

If years of use haven't put waves and ripples into the spade, sawing and filing probably have. Place the metal on an anvil or sheet of flat iron and hammer out all irregularities in its edge surface.





NEWS IN ELECTRONICS

of getting full loudspeaker volume from a phonograph without resorting to amphifiers or tubes. The experimental model shown below is a development of the Electronic Engineering & Manufacturing Co., of Hollywood. Requiring only a D.C. source and operating directly into the voice coil of the speaker, the unit has an output comparable to that of a small radio.

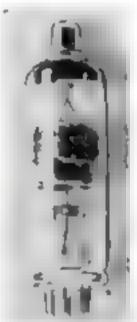


HiGH FiDELITY calls for a loudspeaker that can convert electrical impulses into undistorted sound over a broad frequency band. RCA's dual speaker, below, is designed to give faithful reproduction from 30 to 15,000 cycles per second. Its 15" low-frequency and 2" high-frequency cones are combined so that the larger is a continuation of the smaller. This construction minimizes mutual interference in the cross-over region of middle frequencies where both cones are vibrating at the same time.





cooler operation of radios, especially compact, high-powered equipment, helps to extend tube life and prevent damage to other parts. Aluminum fins on the heat-dissipating sleeve, above, carry heat away from the tube where it is generated. The ventilating device is a surplus war item.



TELEVISION rectifiers must deliver high voltages but don't have to take up a lot of space. The 1Z2, left, produced by Chatham Electronics, of Newark, N. J., is less than 3" long. Two of the midget half-wave rectifiers in a voltage-doubler circuit will supply 20,000 volts at 2 ma. Low dielectric losses make the tube suitable for use in circuits using an R.F. supply.

NEON PILOT lights for use on 115- and 220-volt A.C. or D.C. circuits are made to draw less than 1 ma. but are sometimes inconvenient to install because of the need for a current-limiting resistor. The Dial

Light Co. of America, New York, offers a light-and-socket assembly to solve this problem. It houses a resistor whose value may be selected to suit the voltage or regulate the amount of light desired in any particular circuit.



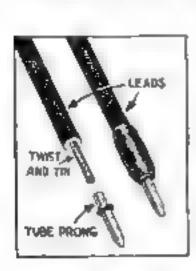


Infra-Red Lamp Rays Flatten Warped Phonograph Records

The even heat of an infra-red lamp can be used to straighten warped phonograph records. Place the disk on a turntable or a felt-covered level surface and let the beam play over it for about five minutes. When warm the record will usually level out by itself, but it may be helped by gentle pressure. Guard against uneven or excessive heating that may damage records.

Serviceable Phone Jacks Made from Prongs of Radio Tubes

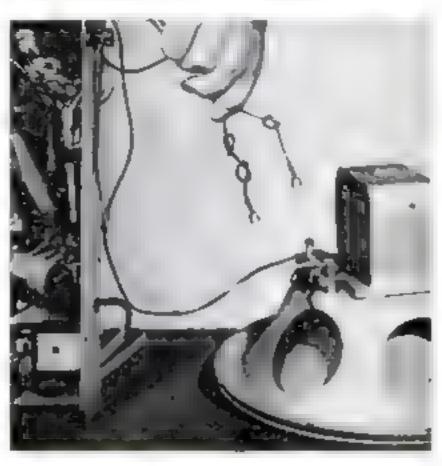
METAL prongs from discarded tubes can be converted into phone jacks for experimental and repair jobs that arise when you've run out of the regular cord tips. Break away the plastic that adheres to the



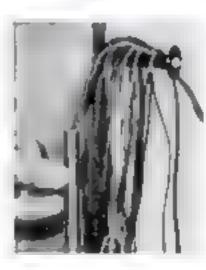
prong, and unsolder the old wires. Heat and tin the apparatus lead, insert it in the prong, and flow in enough solder to hold the wire. Rubber tape wrapped around the upper part of the pin acts as a grip.—A. M. Lindner, In.

Knots Tied in Wires Identify Leads Detached from Speaker

SCREW-LUC connections to loudspeakers usually have to be disconnected when the set is removed from the cabinet for servicing. To make sure that the wires are replaced properly, tie loose knots in the cord ends. The wire with one knot goes to the first terminal, that with two to the second, and so on for all the wires.—H. LEEPER.



Hanger for Radio Test Leads



EMPTY film spools, mounted alongside the shop bench as shown at the left, may be used for hanging test leads and other short wires. The rounded body can't cut the insulation or kink the test-lead wires.

Preheat Chassis for Soldering

When the seams of a chassis need to be soldered and your small iron can't work up enough heat, preheating may be the answer. Clean and clamp the joints, apply a good flux, and place the unit in an oven or over a burner. Warm metal steals heat from a soldering iron less rapidly than cold metal.—A. J. Sharenberger

Still the beginner's choice, crystal receivers refuse to die out. These four de luxe versions will surprise you with the things galena can do.

By FRANK TOBIN

CRYSTAL receivers occupy a unique and honorable position in the history of modern science. Almost to a man, the present generation of engineers and technicians grew up on crystals, and it is this generation that has made electronics a synonym for

progress and achievement.

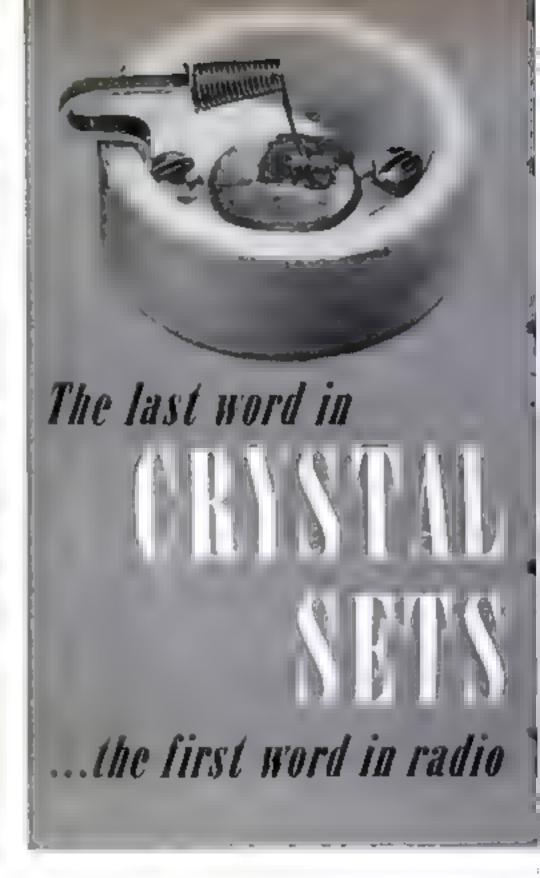
With the rapid advance of the radio art, crystal detectors were forced to give way to vacuum tubes. But as much as they've been shoved into the background, these perennial favorites have never passed out of the radio picture. Beginners and experimenters who like to do a lot with a little still find their simple circuits inviting, especially since new developments in crystals have given a boost to the old-fashioned sets.

Take, for example, the novel radio phonograph shown on the next page. The output of the pickup (which employs a piezoelectric rather than a detector crystal) is sufficient to drive one or two pairs of headphones at full strength and with excellent quality. By using a spring-wound motor in place of the one shown, you can make the outfit independent of a power supply as well as of an

amplifier.

Most of the space in the standard 4" by 10" by 12" cabinet is occupied by the phonograph. One of the newer fixed crystals (type 1N34) is used in the radio. An antenna coil of the type commonly used in A C. - D.C. sets and a .00036-mfd. variable condenser are employed for tuning. Connected between the primary and secondary windings of the coil, a midget .00005-mfd. trimmer adjusts the coupling. The looser the coupling (i.e., the more out of mesh the rotor plates are) the greater will be the selectivity and the weaker the volume. Once it is set for any particular locality and antenna, the trimmer need not be altered.

A pickup with as little as .5-volt output will serve, but one rated at 1.5 volts or more is preferable because the output of the phono crystal is fed directly into the head-phones without amplification. To vary the volume, use different needles. Soft needles give less headphone volume than hard ones.



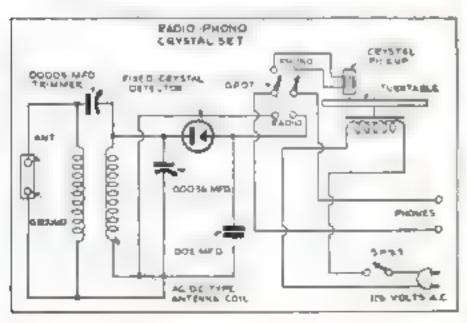
Too much power can sometimes be as bad as too little. Standard crystal receivers used close to several high-powered transmitters often fail to separate the stations, and it is to overcome this weakness that two separate tuned circuits are employed in the superselective receiver illustrated at the top of page 192. Coils L1 and L2, together with a .00036-mfd. variable condenser (C1) form the first tuned circuit; L3 and C2 form the second. Selectivity is obtained in this fashion without sacrificing signal strength.

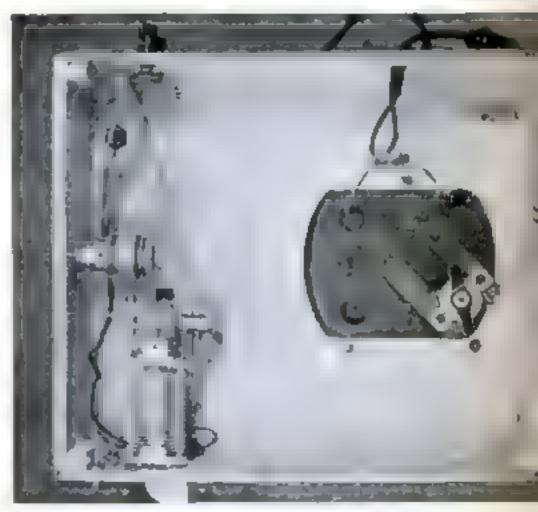
All the coils are wound on a 25" tube 65" long. Use No. 24 enameled wire throughout, winding 50 turns for L1, 25 turns for L2, and 60 turns for L3. When a long outdoor antenna is available, better results can be obtained by connecting it to the midpoint of L1.

Closest in design to the conventional crystal set that has been popular since the begin-

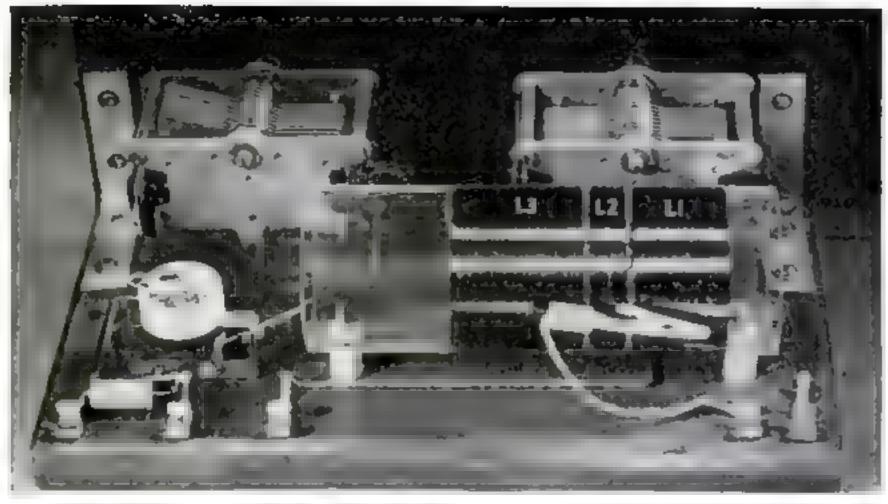


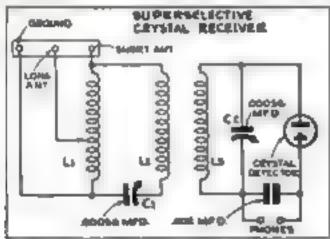
Radio-phonograph combinations strike a new note in crystal-set construction. The complete yet extremely simple unit shown at the right depends upon two relatively recent developments. First is a high-autput pickup that can operate headphones directly without amplification the second is a preset, fixed-crystal detector. Because this crystal requires no manual adjustment of its cat a whister, the entire radio can be tucked out of sight inside the cabinet.





FEB. 191

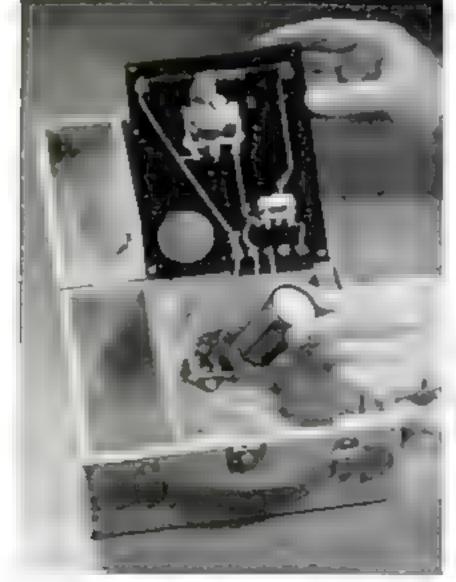


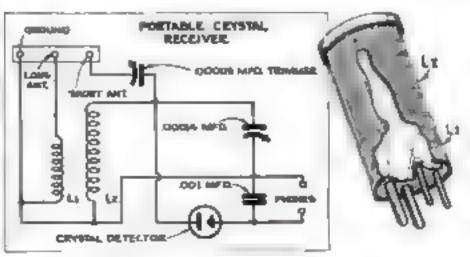


Two separate tuned circuits enable this receiver to distinguish between two or more powerful signals. The alligator clip is used to centertap the antenna coil, Lt, when a long aerial is available.

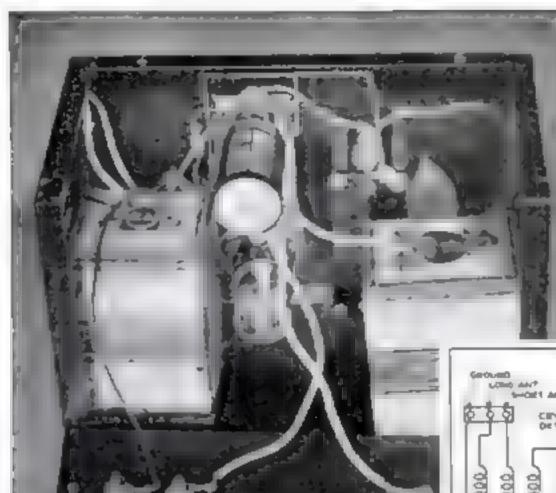
ning of radio is the compact portable shown below. To cover the entire broadcast band with its .00014-mfd. condenser, two sets of coils are needed. These can be made interchangeable by winding them on a pair of 4-prong, 1%" plastic forms. For use between 200 and 350 meters, L2 should consist of 100 turns of 32-gauge wire, and L1 of 40 turns of No. 36. Leave 1/16" to %" space between the two windings. Stations operating in the 350 to 550-meter range can be tuned in with a coil that consists of 170 turns of No. 34 (L2), and 60 turns of No. 36 (L1). As before, enameled wire is used This tiny set makes a fine traveling companion. For

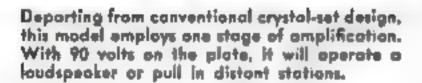
This tiny set makes a fine traveling companion. For use on comping trips, carry a long call of antenno wire and a spike that can be driven into the ground.

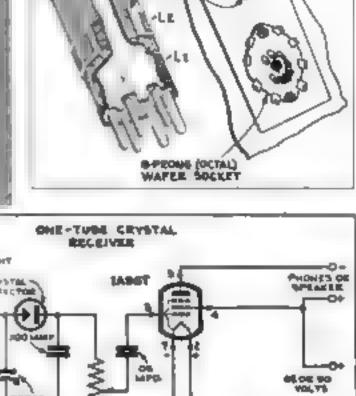




192 SCIENCE







GPROME WATER SOCKET

PANEL

CAPTRONES JICHUATURI

US WOLT

for all windings. The small left-hand compartment in the 4" by 7" by 8" cabinet will hold a single headphone, the extra coil, a hank of antenna wire, and a ground connection. A stock cabinet is illustrated in the photo, but one hke it can easily be gloed up out of thin wood stock.

Because crystals can only detect a signal without amplifying it, they rarely give satisfactory performance when used at a distance of 50 miles or more from the transmitter. If you want to double the radius of useful reception, however, you can add an amplifier tube as is done in the circuit pictured above. For phone reception, 45 volts on the plate of the IA5GT should be sufficient. In addition, local broadcasts may often be picked up with a loudspeaker connected in place of the phones. For speaker operation, plate voltage should be increased to 90. A separate A battery supplies the 1.5 volts needed by the filament.

For the sake of simplicity, all the parts are mounted on the front panel of the metal cabinet. As the chassis panel is grounded, and it is necessary to keep the tube and coul sockets from making contact with it, a cardboard insert is placed between the panel and the sockets as shown in the drawing. Windings L1, L2, and L3 consist of 40, 70, and 110 turns respectively. For the first pair use No. 36 enameled wire, and for L3 use No. 32. Wrap a strip of tape around the lower end of L3 and wind L2 over the tape. When tuned by a .00036-mfd. variable condenser, this coil will cover the entire broadcast band. The close coupling of L2 is intended to increase signal strength when the set is used with a short antenna.

Several types of crystal detectors may be purchased from radio supply stores, and three different ones have been employed in these four circuits. As far as performance is concerned, any of them may be used in any of the sets, but a fixed, preset crystal is suggested wherever the layout requires that it be placed in some inaccessible spot.

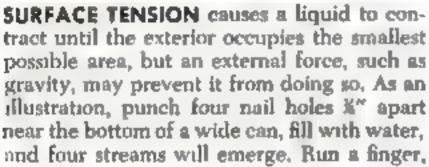
When using an adjustable crystal, move the cat's whisker carefully over the surface while turning the condenser slowly backward and forward until a sensitive spot is found. Don't bear heavily on the contact, and try to avoid touching the crystal with the finger tips as any only film on its face will reduce the number of sensitive spots.

For maximum performance with any crystal set, use a long outdoor antenna and a good, clean connection to ground.

HOME EXPERIMENTS

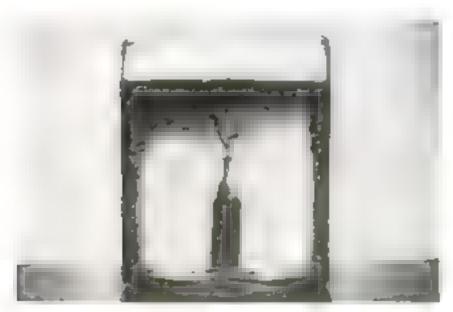
FLUIDS







held vertically, from one side to the other across the four streams—and they will become one because surface tension over-powers the force that originally kept them apart. Strike a finger, held horizontally, downward across the merged stream near the can and the stream again will separate.



WATER FLOWS UPWARD in a heating system because liquids are lighter in weight when expanded by heat. You can show this by pouring hot water into a vial containing a little ink and standing the vial, mouth open, in a jar of cold water. A plume of hot inky water will rise to the surface and spread like a cloud from a miniature volcano. As the ink cools, gaining density, it slowly descends and mixes with the water.

WATER SEEKS ITS OWN LEVEL, according to an old adage, but here is a trick that seems to offer proof to the contrary. As you can see, the liquid in the bent glass tube in the ac-

companying photo stands higher in one leg than in the other. That there is no partition in the tube can be proved by causing the liquid to oscillate between the two legs. Actually, the tube contains two liquids. These should look alike but differ in weight. One may be water, and the other a liquid such as benzine or carbon tetrachloride that will not mix with water. The tube should be held so the fingers conceal the juncture of the liquids, although it will be barely noticeable.



Obey Curious Laws

WATER PRESSURE increases with depth, as you can show with a flat piece of lead and a straight glass tube. Attach a piece of thread to the center of the lead and smear petrolatum on the lead and end of the tube to make a watertight seal. Then, holding the lead against the end of the tube with the thread, lower the tube almost to the bottom of a glass of water. If you now release the thread, pressure will hold the lead in place. But slowly raise the tube, and finally the pull of gravity will overcome the decreasing water pressure, allowing the lead to fall.





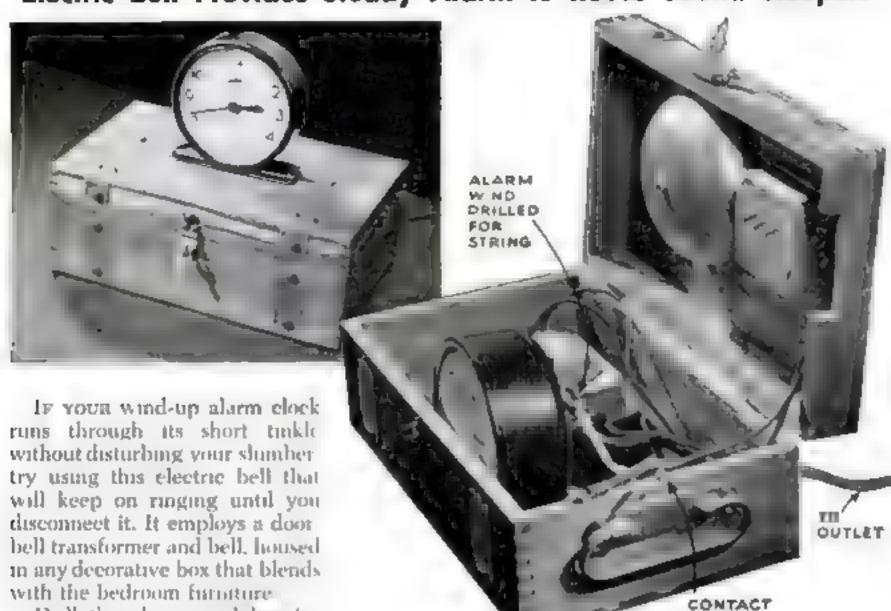


entirely different specific gravity. A demonstration of this can be turned into an interesting dinner-table stunt. Pour an equal amount of coffee or tea into two small glasses, and in one dissolve as much salt as you can. Then put a soda straw into each glass and suck gently on both straws at once. Providing you don't cheat, the heavier salt solution will not rise as far as the beverage.

HOT LIQUIDS flow more easily than cold ones, a fact that is obvious in the case of such normally viscous liquids as heavy oil or molasses. Even in a liquid as thin as water, heat has the same effect. As a demonstration, make a hole with a very fine needle in the bottoms of two identical cans. In one, place ice water and in the other the same amount of hot water. Set each over a glass, as at the right, and watch the race. The hot water will flow much faster. In fact, if the hole is small enough and the water level not too high, the cold water may not flow at all.



Electric Bell Provides Steady Alarm to Rouse Sound Sleepers



Drill the alarm wind key for a string field to a small rod, A

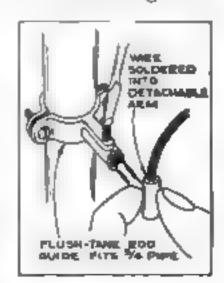
spring mounted along one edge of the box acts as the moving contact, while the other connection is carried to a screw head placed beneath the free end of the spring. Bend the last turn of spring wire flat and fill

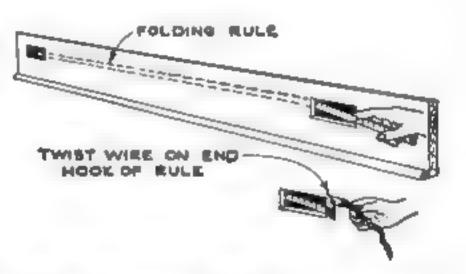
it with solder. When the clock goes off, the unwinding key pulls the rod from under the spring and starts the bell jangling. The contacts can be placed on a ledge inside the box if you'd rather not notch the edge.

Flush-Tank Guide Forms Handy Detachable Ground Connection

WHEN it is desirable to install a pipe ground clamp from which the wire can be readily detached, a rod guide of the type used in toilet flush tanks may be made to serve. To install it, clamp the body of the guide to the pipe, and solder the ground

wire into the detachable arm as shown. The arm is then inserted in the guide socket and locked in place with the setscrew. This arrangement will be found particularly convenient in hard-to-reach places when the wire must be removable.





Wire Fished with Folding Rule

SHORT wire-fishing jobs encountered when installing horizontal wiring in studiess partitions and behind built-in cabinets can be done with a folding carpenter's rule, as shown above. Rigid enough to support itself horizontally, yet flexible enough to snake around obstructions, a rule often proves more controllable than conventional fishing wire or ordinary cable.—J. Modroch.

Table Magic

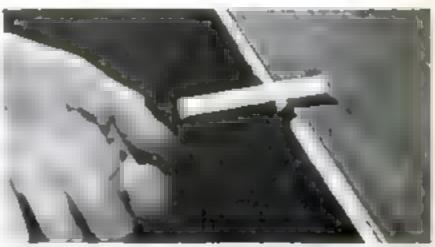
RING OF MYSTERY. Thread a paper ring on a string, give the ends of the string to a friend, and announce you will remove the washer intact while he holds the string. Throwing a handkerchief over your hands, you grasp the ring, and in two shakes your hands emerge—an untorn ring in your hand and the string empty. How? By concealing a duplicate ring in your hand, tearing off and palming the original, and showing the duplicate.

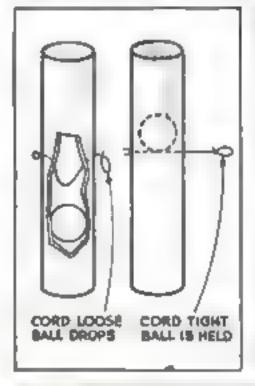
cigarette and place it on a bare table with more than half projecting over the edge. Everyone will expect the cigarette to fall. That it does not will brand you as a magician. The trick is to moisten a fingertip and touch this to the underside of the cigarette at the end which you then press against the table. This moisture acts as an adhesive to keep the cigarette in place.

MAGIC BALL AND TUBE. A mailing tube and a ball that is slightly smaller are needed for this stunt. First, hold the tube vertically and drop the ball through. Next announce that you can so charm the ball that it either will fall through or stay inside. Then produce exactly this effect. A piece of thread through the tube as shown makes it possible to do the trick. One end is knotted; the other is looped over your thumb. When the thread is pulled taut, the ball cannot pass. To let the ball through, slacken the cord.

VANISHING BALL, Place a small ball in your right hand, cover the hand with a handkerchief, and ask everyone in turn to feel under the handkerchief to make certain the ball still is there. When the last person has reported that the ball is there, remove the handkerchief-and the ball is gone. Now replace the handkerchief, and let everyone feel to make sure the ball is not there. Again, when all have had a turn, pull off the handkerchief-and the ball is back. The method used is almost too simple to be behevable. Here it is: the last man to feel the ball is a confederate. In the first place, he removes the ball; in the second, he replaces it. Don't repeat the trick too often, though.











FEB : 197

Colloids . . . LIQUIDS

Curious suspensions of certain insoluble substances act like neither—or both.

By KENNETH M. SWEZEY

USUALLY we think of physical matter in terms of solid, hquid, or gas, but there is one form that does not fall clearly into any of these three classifications. Science first observed this about the middle of the last century when Selmi, Berzelius, and Faraday produced water-clear hquids containing sizable quantities of insoluble solids such as sulphur, Prussian blue, and even pure gold. In the ordinary sense, these substances were not dissolved in the liquid; yet they remained suspended and could not be seen by even the most powerful microscope.

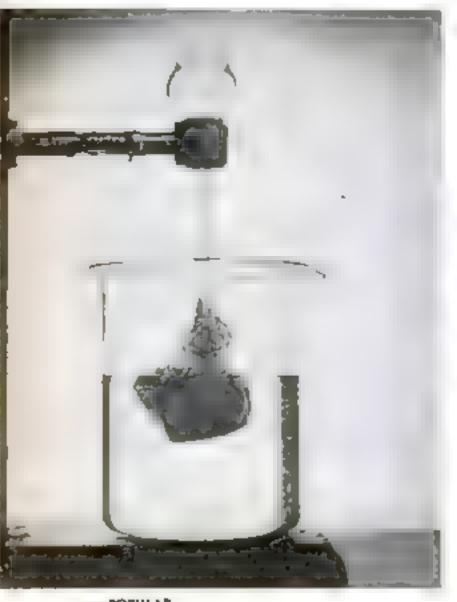
A few years later, an English scientist,

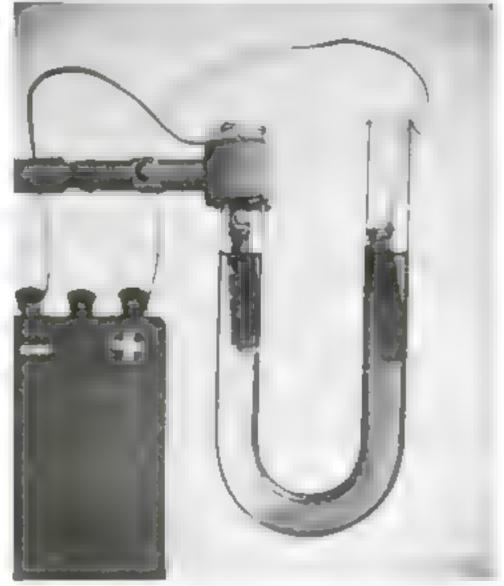
Thomas Graham, published his discovery that substances truly dissolved in water would pass freely through parchment paper or animal membrane, while other substances such as gelatin, glue, and the strange liquids just mentioned would not. He reasoned that those that would not were distinct substances, and, as most of those he experimented with were gelatinous, he called them colloids, from the Greek word "glue" To distinguish his colloidal suspensions from true solutions, he called them sols.

Subsequent investigation has indicated that colloids are not distinct substances, but actually a state of matter intermediate between solid and liquid. It is a question of

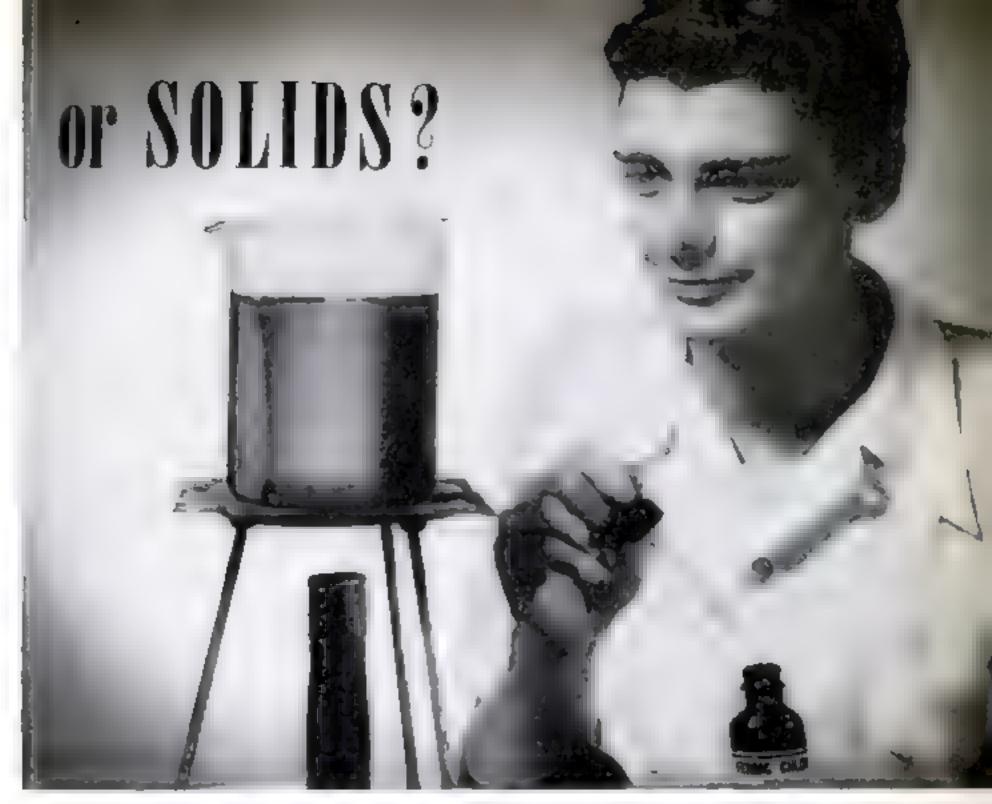
Sols are purified by dialysis. When the sol is placed in a semipermeable bag suspended in water, dissolved substances pass through the membrane, leaving the colloid behind.

Most colloids possess an electrical charge. You can show this by applying voltage to a sol of Prussian blue. Since this sol is negatively charged, its particles are repelled by the negative electrode and attracted by the positive.





198 SCIENCE



Ferric chloride solution, added slowly to boiling water, yields hydrous ferric axide in colloidal form.

particle size, rather than kind of material. The smallest particle having colloidal properties is larger than most molecules while the largest still cannot be seen with an ordinary microscope.

Under suitable conditions it is possible to produce almost any substance in colloidal form. This may be done by several methods. The particles may be built up, or condensed, by the reaction of atoms, molecules, or ions; they may be broken down, or dispersed, by disintegration of larger particles.

You can demonstrate this in your home laboratory. Hydrous ferric oxide, which is usually called ferric hydroxide, Fe(OH)_m can be easily condensed into colloidal particles by adding a concentrated solution of ferric chloride to boiling water. The chloride, FeCl_m is rapidly hydrolyzed (that is, decomposed), changing into particles of hydrous ferric oxide so minute that they may remain suspended for years.

This may be observed by adding several drops of ferme chloride to a beaker of boil-

ing water, set swirling by stirring. The pale yellow of a dilute ferric chloride changes, almost instantly, to the deeper reddish-brown of hydrous ferric oxide.

Enough of this sol for experimentation may be made by adding 50 drops of a concentrated solution of ferric chloride, freshly prepared, to 500 ml. of water that is just barely boiling. Add water occasionally and boil until the sol becomes clear and reddishbrown. (By boiling too vigorously, or by adding the chloride solution too fast, you may cause the ferric oxide to be precipitated. If that happens, you must begin again.)

When ferric chloride is hydrolyzed, hydrochloric acid also is formed, remaining in the sol. To remove it, you must use Graham's famous method of separation, dialysis. Both acid and colloid will pass through the pores of an ordinary filter, but a membrane with much finer pores will hold back the hydrous ferric oxide particles.

Graham used pig bladders and parchment paper, but today collodion films and nonwaterproofed cellophane serve more effectively. Cut a disk of the latter 8" or 10" in diameter, shape it into a bag, and tie the end around the outlet of a small funnel. Half fill this bag with the sol, and suspend in a large dish of water. After a few minutes, place blue litmus paper in the water around the bag. The water will turn pink, indicating it has become acid. Continue the dialysis for several hours, changing the outside water frequently

One reason that colloids stay in suspension, against the pull of gravity, is because the molecular movements of the sustaining bound bounce the small particles back and forth. Another is that most colloids repeleach other because each contains an electrical charge. You can demonstrate the latter property by attaching a 45-volt or 90-volt radio B battery to carbons taken from two flashight cells and inserting the carbons in a glass U-tube filled with a sol

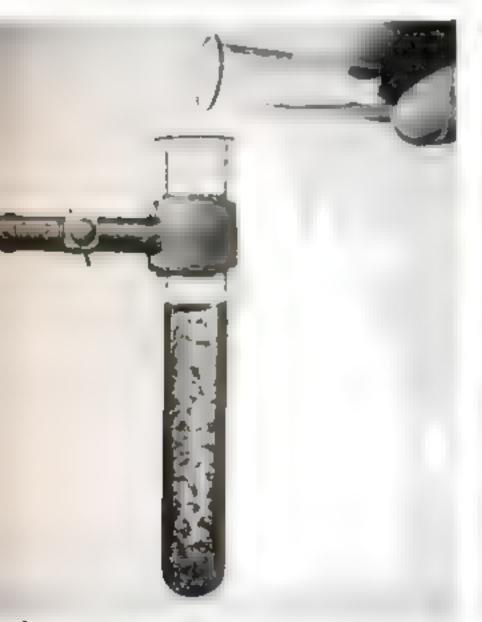
A sol of colloidal Prussian blue responds strikingly to this test. You can make this sol by adding, with gentle stirring, just 2 drops of a saturated solution of ferric chloride to 100 ml. of water which contains 12 drops of saturated potassium ferrocyanide solution. Immediately the previously waterwhite solution turns a deep blue. Dialyze this blue sol as you did the hydrous ferric oxide. Then pour it into your U-tube and apply voltage. After a few minutes, you will notice the blue coloring is being pushed from the negative electrode and is concentrating at the positive.

Prussian blue in sol form is negatively charged. Hydrous ferric oxide, on the other hand, is positively charged, as can be proved by repeating the experiment with the other chemical. The movement here, however, may not be so pronounced, for this substance tends to precipitate when it concentrates at the negative pole. Many dyes are colloidal and are selectively attracted to different types of textile fibers largely because of an electrical charge.

As you might guess, the particles in negatively and positively charged sols, when added together in the proper proportions, are attracted to each other. Therefore, the charges are neutralized, and the particles

If negative and positive sols are mixed, the particles will neutralize each other. Usually, they also coalesce and are then precipitated. Here, a hydrous ferric axide sol is added to another of Prussian blue.

Mix dilute solutions of potassium ferrocyanide and ferric chloride, and you produce a colloidal blue sal that leaves hardly a trace of blue in passing through a filter, left. But mix concentrated forms of these substances, and the particles are so large that the filter holds them back.





often fall out of suspension. You can verify this by adding hydrous ferric oxide sol to some sol of Prussian blue. Large particles will form and fall to the bottom.

Acids, bases, or salts added in sufficient quantity to an electrically charged sol also will discharge it and cause precipitation. In city water systems, this is the principle involved when aluminum or iron sulphate is

added to clarify muddy water.

Sometimes substances may be prepared in either colloidal or grosser form, by controlling the concentration of the substances. If you pour Prussian blue sol into an ordinary filter, the blue will pass through, leaving no solid matter and hardly coloring the filter. But make a new batch of this blue. this time adding 10 drops of ferric chloride solution and 20 drops of potassium ferrocyanide to 100 ml. of water, pour it into a filter-and note the difference. Although the first ml. or two of the filtrate may be pale blue, the remainder will be colorless and a precipitate of the blue pigment will remain in the filter. Chemically, the two Prussian blues are almost identical; physically, the

first is colloidal while the second is not.

One method of breaking down large particles to make them of colloidal size is called peptization. You may demonstrate this process by pouring a dilute solution of oxalic acid through the precipitate of gross Prussian blue on your filter. Immediately the blue begins to pass through the pores of the filter. If the filtrate is subsequently dialyzed to remove the oxalic acid, the blue will remain in colloidal form

Colloidal Prussian blue was once an important writing ink, but amiline dyes are now

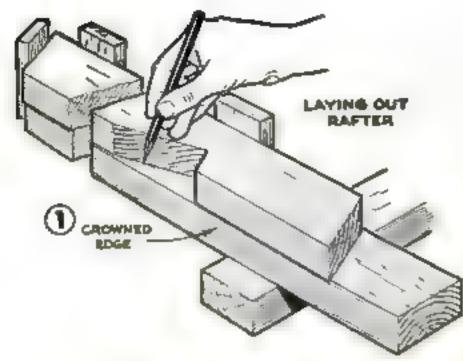
more commonly used.

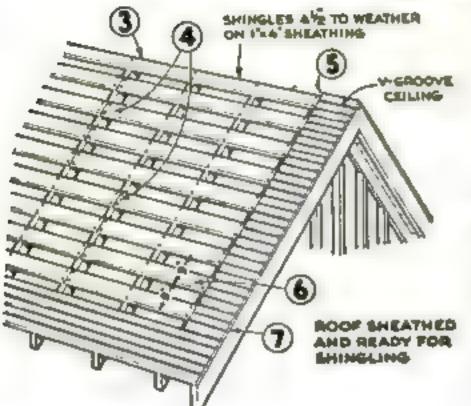
Colloidal particles may often be produced by diluting a solution containing some solid with another liquid in which the solid will not dissolve. By pouring an alcoholic solution of sulphur, for instance, into water, a milky sol of sulphur can be formed. The whitening of newly applied shellac by drops of water is another example, the water diluting the alcohol in which the sheliac resin is dissolved. As the resin will not dissolve in the water, it is precipitated as colloidal particles that disperse light and look white.

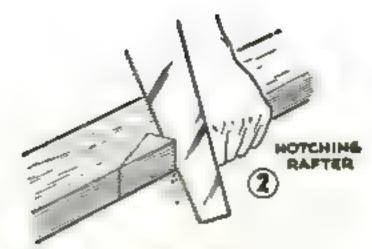
If you pour a dilute solution of analic acid over the big particles left on the filter in the experiment at left, they will break down into particles of callaidal size and pass through the filter, as seen below. This process of breaking and dispersing particles is called peptization. If a solution containing a solid is diluted with a liquid in which the same solid will not dissolve, colloidal particles are often produced. Here is a familiar example—the spots formed when water drops on shellar.











What's Wrong?

SEVEN errors in building a roof are shown in the three drawings here—one each in the drawings above and five in that at the left. The points at which to look for errors are numbered. When you have decided on what you consider wrong, turn the page upside down and compare your answers with those given below.

7. The thingle molding is mining,

6 Specing on \$14" centers permits uniform shingle life.

present states for more ground and the bases become

edi of briefe bligde abused anlies sett blad funds. 8

tokether chould be staggered with no more than two

3, A filler strip must be nelled at each side of the ridge to provide solid nathing for rip-rap or other trim,

port the saw,

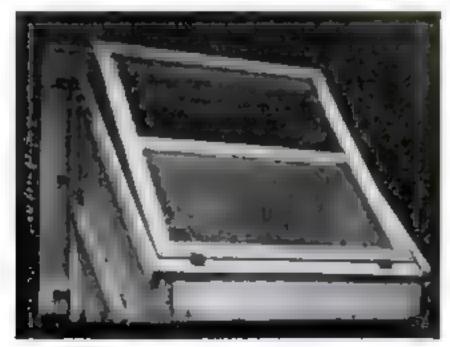
-que glad lilw stanw acts or that stars git out adult &

 Since refers are laid crowned edge up, the piods being marked for notching should be turned over.

VINZMERS

Greenhouse in Cellar Window Gives Seeds Start in Late Winter

Adjoining a basement window on the south side of a house, this glazed seedling box gets warmth both from the cellar and



the sun. If a window sash is on hand, the box frame may be built of 1" by 2" stock to fit it and the easing on which it is to be used; if not, a suitable sash frame may be made of 1" by 2" stock and glazed.

Notch the frame to fit snugly over the sill so that when the box is screwed to the casing most of the weight will be on the sill. The box can be lightened by making the bottom of plywood or composition board. A lattice shelf may be installed, but don't make it so deep it will keep sun from pots at the rear. Apply weatherstrip along the casing and window joints.

The hinged sash can be raised and the window closed on warm days. Use hinges with removable pins and take the sash off when the box is stored.—A. F. STILSON

202 SCIENCE

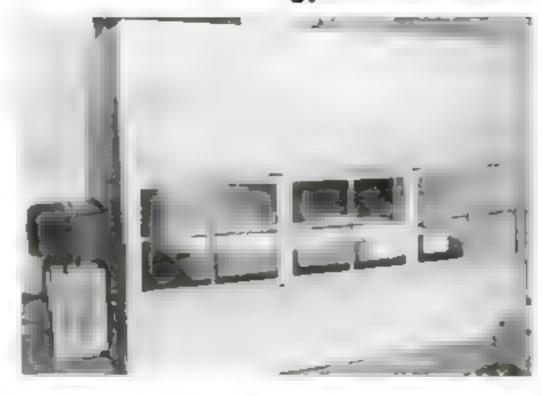
Sleeping Cubicle Has Air Filter for Allergy Sufferers

Persons who suffer from hay fever or asthma can frequently lessen the attacks by sleeping in an atmosphere free of dust and pollen. Equipped with a ventilator and filter, the cubicle shown here provides such sleeping quarters for a child who is allergic to household dust

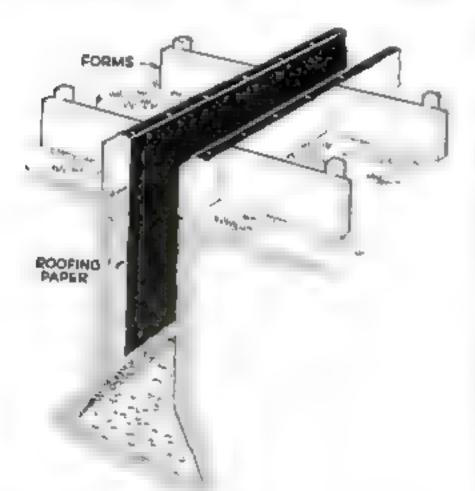
At the same time it leaves the rest of the bedroom free for other uses. In summer, the ventilator, placed in a bedroom window, blows outside air into the cubicle through a hole in its wall. In winter, this hole is closed, another opened, and the ventilator placed

to blow bedroom air through it into the cubicle. Windows prevent a shut-in feeling.

Framed with 1" by 2" pine, the cubicle is 5' wide, 6' high, and 8' long, hard-finish wallboard being used inside for quick cleaning. Built in sections fastened together with



screws, the room may be easily taken apart. Bottom edges of the walls are felted so the entire cubicle may be moved around. It has no floor. Space must be left under the door or elsewhere to allow air leakage from the cubicle.—William Allehin.



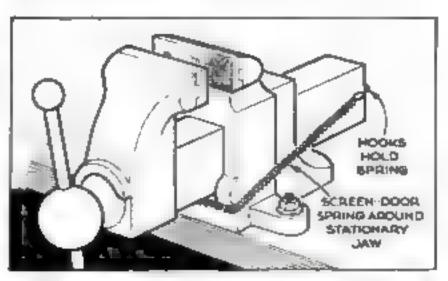
Roofing Paper Provides Seal When Pouring Foundation

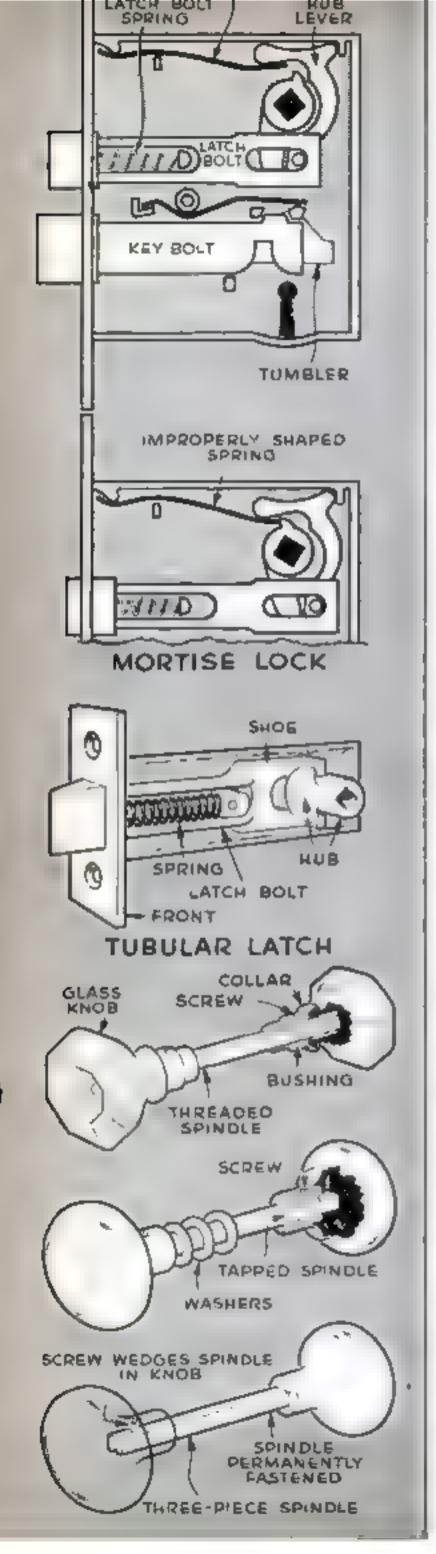
FOUNDATIONS for small buildings frequently are made by pouring the concrete directly in a trench, usually 12" wide and 3' or 4' deep. A form is needed, however, to retain the portion above ground, and at this point difficulty may arise if the ground is uneven, for the concrete leaks between the earth and the bottom edge of the form.

Roofing or building paper nailed to the top of the forms and allowed to hang down the sides of the trench makes an excellent seal during the pouring. It also permits easy removal of the forms and greatly improves the appearance of the finished work. Only that portion of the paper above ground is removed.—Henry Hansony.

Spring Overcomes Lag in Vise

AFTER long use, the screw threads of a vise often become worn and the jaws are insensitive to small movements of the handle. This lag may be overcome by stretching a screen cloor spring around the stationary jaw and hooking the ends to the rear corners of the slide. Two springs may be needed on a large vise.—Andrew Vena.





Turning Old

By CHARLES KIMBALL

ONE good turn of a doorknob deserves a ready response. If you don't get it, the knob or its spindle may be binding, the knob screw loose or lost, one of the latch springs broken, or the mechanism gummed with oil—all faults that can be corrected without resort to a locksmith's services.

Knobs sometimes stick because they have been set so close together that the ends of the shanks bind against the roses or escutcheons. All that is necessary is to remove one knob screw and set the knob back far enough for the screw to go into the next spindle hole. Spindle washers may be required to get the right adjustment between knobs.

Occasionally when plates are installed, the roses are out of alignment with the center of the hub in the lock, causing the spindle or the shanks to bind. Removing

and resetting the plates is the remedy.

A knob may pull or fall off when the screw that holds it on the spindle is loose or missing. If the screw has been lost, a setscrew having the proper thread may be substituted or the knob and spindle taken to a locksmith or hardware store and fitted with another knob

screw of the proper size.

Sometimes an old knob screw won't tighten because of damaged threads, and a new one can be put in. If the new one can't be tightened, the threads in the spindle are damaged or worn. Retapping may fix that; both knobs may be adjusted over a new set of holes, one end of the spindle being sawed off, if necessary, to fit its knob; or a new spindle may be required. Modern locks take spindles of a few standard sizes, and hardware stores carry an assortment.

One quick remedy is to coat the threads of a loose screw with shellac, lacquer, or fingernail lacquer. In this event, when the screw must be removed again, it may be necessary to let a little solvent, such as alcohol or fingernail-polish remover, soak onto the threads. Penetrating oil brushed on stubborn, rusted screws may loosen stuck threads. The treatment may be required for several days in succession. As a last resort, the knob shank may have to be heated with a blowtorch. A mask cut from tin-can stock to fit snugly around the shank will protect the door and plate if both knobs are stuck and the heating has to be done while they are still in place on the door.

Knob screws that have been burred by a screwdriver should be smoothed with a small file, or cut fingers may result. When a knob is screwed to a spindle, the screw hole in the shank should be above the horizontal no matter which way the knob is turned. In this position the screw is less likely to drop out if it works loose.

204 SCIENCE

DOORKNOBS Into New

A pair of knobs will rattle and slap against the plates when they are spaced too far on the spindle. Loosen one and move it a hole nearer the door or put washers on the spindle to take up the slack, dividing them evenly on both sides. If the spindle is threaded, loosen one knob screw, turn the knob clockwise to adjust it, and retighten the screw. One or two washers may be needed to keep the screw on top.

When a knob turns without working the latch, it is probably on a threaded spindle and its screw has worked loose. A glass knob under severe usage may work loose from its metal collar and can be repaired, if the bushing is open at both ends, by tamping in fron cement. For a door of average thickness, one end of the spindle will have to be sawed off before reassembling. Glass knobs with bushings closed at one end can't be repaired. A hollow cellulose-acetate knob may pull free from the metal bushing on the spindle and will have to be replaced.

In mortise locks with two springs in the latch-bolt mechanism, a hub-lever spring sometimes breaks with the result that the latch-bolt spring will return the bolt but feebly to the outer position when the knob

is released. To replace the spring, remove the spindle and unscrew the lock at the edge of the door; then press a screwdriver into the spindle hole and pry out the lock. Take care not to spill out the loose parts.

The knob of a lock equipped with a freeaction latch mechanism sometimes fails to unlatch fully when turned toward the jamb stile but operates the latch bolt perfectly when turned toward the hinges. This is caused by a hub-lever spring interfering with the upper cam of the hub. The spring should be rebent properly or shortened.

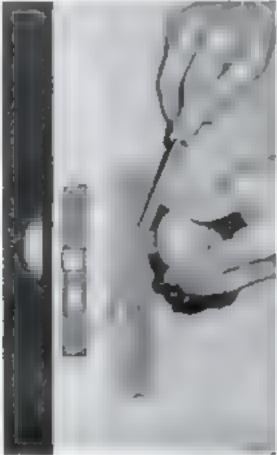
Sluggish action may be due also to lubrication with oil, which collects dust and becomes gummed. A sticking lock must be removed from the door and soaked thoroughly in a solvent. Work it a few times with a screwdriver in the hub and the key in the keyhole, drain out the cleaning fluid, and dry. Then lubricate with powdered graphite. Locks and latches should be lubricated periodically with graphite blown in at the retracted latch bolt and in the keyhole.

Tubular latches, often used on inside doors, are an exception to the graphite-lubrication rule. Most makers recommend petroleum jelly for the bolt mechanism.

Simply tightening the screw will often ours faulty operation of a knob. Screws kept above center are less likely to fall out. Knob-screw heads that have been burred by a screwdriver can cut or scratch a finger if they are not smoothed off with a file.

Graphite is the lubricant used in mortise locks. Puff it in white the latch is retrocted. Oil gums and makes a latch sluggish,



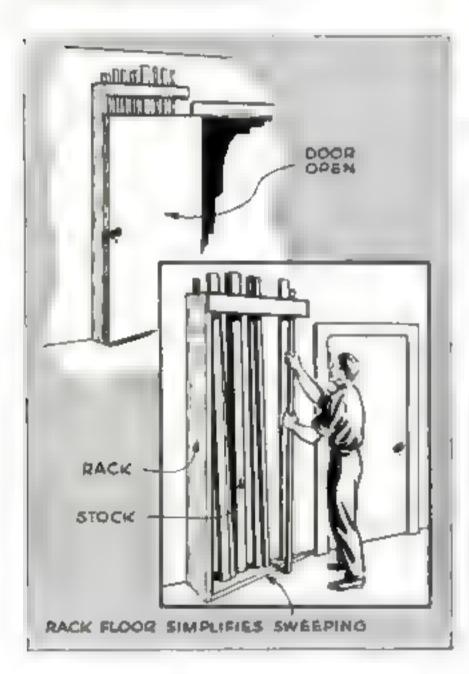




1947 205

Wedge-Shaped Storage Rack Uses Waste Space Behind Door

When wall and floor space is at a premium, you can utilize normally wasted areas in the shop with storage racks similar to the one below. This type of wedge rack can start right at the door jamb and work out into as wide or narrow an are as the normal door swing dictates. For such long, narrow stock as pipe, the are can be limited to a size that will cause no interference with the full movement of the door.



Pin Puts Life in Lighter Wick

Windproof lighters often fail to work when the wick spreads or lies against the shield. This can be prevented by cutting the



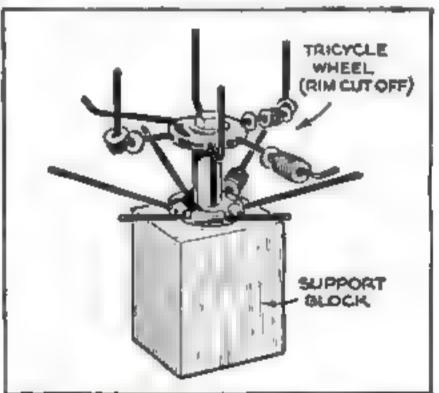
head off a common pin and pressing the pin down through the wick to support it upright. Besides igniting more surely, a wick so supported will also last much longer.—

Dox Leibenguth.



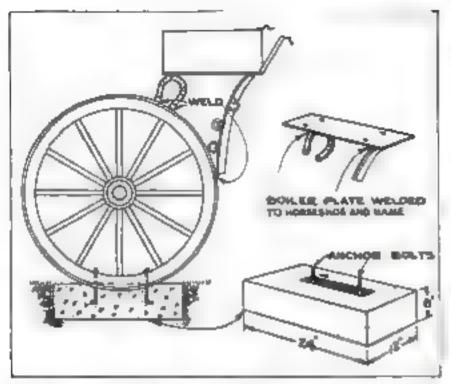
Emergency Belt for Power Tools

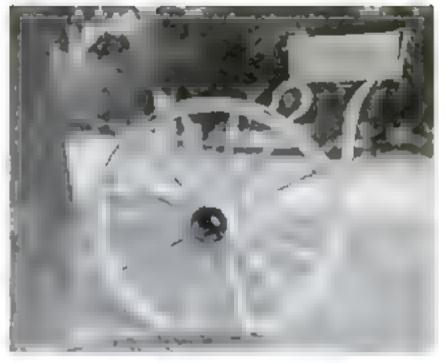
EMERCENCY replacement of a worn-out V-belt can be made with a length of sash cord. Place the cord over the two pulleys and join the ends with as small a knot as possible. Wrap the joint with friction tape, as shown above. The improvised belt will seat itself with the knot on the outside, and will give good service until a regular belt can be obtained.—Ken Murray.



Rack Made from Tricycle Wheel

BOLTED by the hub to a support block, the center portion of a wheel from an old tricycle or baby carriage makes a rack for holding washers sorted in sizes. The top row of spokes should be bent upward so washers won't slide off.—Louis M. Goodman.





Wagon Wheel Supports R.F.D. Box by the Side of the Road

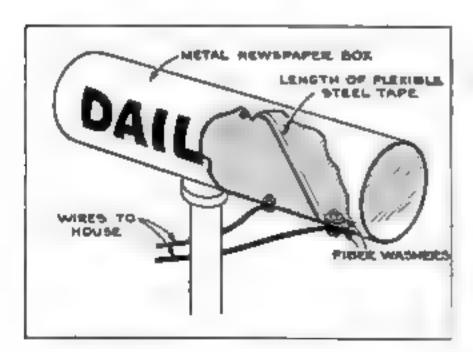
Anchored to a concrete block set in the ground, this wagon-wheel mailbox support brings a pleasantly old-fashioned note to the rural home near which it stands.

A horseshoe and hame serve as brackets for the piece of boiler plate to which the box itself is bolted. Located so as to bring the

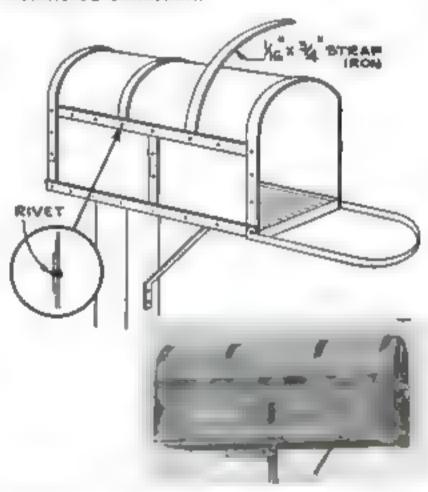
Signal Light in House Shows Newspaper Has Been Delivered

WHEN I want to know whether the daily paper has been delivered in the cylindrical metal box down the hill from my home, I press a doorbell button in the house to see if a small light comes on. If it does not, I know the paper is in the box.

The switch, light, and a 6-volt battery are wired in a circuit stretching between the box and house. Normally, a length of flexible steel tape attached to an insulated terminal makes contact with the box, giving a complete circuit and lighting the lamp when the button is pressed. Putting in the paper breaks the circuit.—George Zinserling.



box level, the horseshoe and hame are welded to both the tire and boiler plate. The anchor bolts, embedded in the concrete, pass through holes drilled in the rim and keep the wheel rigid. While the wheel may be painted, it looks fine if left in a natural, weathered condition.



Mailbox Looks Like Old Trunk

IF you are tired of looking at the plain lines of a standard rural mailbox, it can be made more interesting by riveting on strap iron to suggest one of the old round-top trunks common in grandpa's day.

To carry the illusion still further, paint the box a light tan before installing the strap iron, paint the straps black, and stencil the name in white. Copper rivets evenly spaced will increase the effect.



New Hydraulic Lift Unit for Jeep Facilitates Work on Farm

WHEN attached to the underside of a jeep, a new hydraulic lifting unit now on the market makes it possible for a farmer to raise or lower a plow or other farm implement hitched to the jeep simply by touching a dashboard button. A hydraulically activated piston operating the extension bracket

FOR EASIER

FARMING

to which the hitch is made may be seen under the rear of the jeep, at left above. Power is provided by a pump located directly in front of the oil filter and driven by an extra belt from the crankshaft. Known as the Love Hydraulic Lift System, the unit is distributed by the Newgren Co., Toledo.

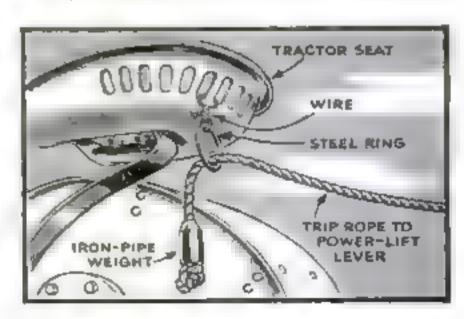
Varied Attachments Make Garden Tractor a Jack-of-All-Jobs

ALTHOUGH intended primarily as a lawn mower, a hand tractor now being produced by the Lodge & Shipley Machine Tool Company, of Cincinnati, has attachments for performing such other jobs as cultivating the garden, planting seeds, and clearing snow from a walk. The manufacturer also plans to offer a small plow for the tractor.



If you are accustomed to tying the trip rope to your tractor seat, this arrangement will be an improvement. Then, if you forget the rope when you uncouple the tractor and drive ahead, the rope will not be broken or the power-lift lever bent.—RAY HARRISON.





208 SCIENCE



JUDGE BROWN'S CAR

Judge Brown is a fine man and I sure wanted to help him out

But his old car, with 87,000 miles on it, had certainly seen better days Fir one thing she was really pumping on

He said Now, Frank, I've just got to have it Wednesday morning for a case in Kirby "

Boy, I really slaved over that car. Pulled the motor down ground the valves, put in a set of Perfect Circle Piston Rings, new gaskets, and other things she'd needed for a long time

Then I "sewed her up," so to

speak I certainly felt as though I'd just performed a major operation — and I had'

Well the way that car ran was a pleasant surprise to the judge. He should have brought it in long be fore he did and saved himself a lot of needless trouble and expense.

Anyway, that's my job They call me a Doctor of Motors , and I guess I am

N TO LE DYNESS

Pariet Order on evaluate of every outermative repair shop. Your favorite mechanic—your Doctor of Maters recommends them.

THE PERFECT CIRCLE COMPANIES, HAGERSTOWN, IND., and TORONTO, ONT.

PERFECT CIRCLE

MOTORS



This is it! The sweet and handy set you woodcarvers, model builders and artists have been clamoring for the super-topnotch job you expect and get from X-acto.

Six scalpel-sharp, new chisel and gouge blades, each a different chape, each designed with an ingenious architectural rib in the tang end to give you the special rigidity you need for deep cuts, curves and angles. Plus a half-dozen other X-acto blades and a specially designed. X-acto handle into which all blades fit interchangeably.

What versatility! You can use this new No. 77 for anything from a life-size statue to a tiny scale-model plane ... and know you'll do a better, quicker job, as always with X-actol



"The Big Shot?"

It's got everything? Knives, plenty of blades, specially designed bobbycraft tools for every ameting job. Contains: 3 X acto Knives, complete assortment of blades, stripper, sander, planer, saw, drills and holders; ruler Complete in wooden cheet \$12.50

X-QCTO*



Singly or in sets, 25c to \$45.

At hobby, gift and hardware shops

X-acts Crescent Products Co., Inc., 440 Fourth Av., N. Y. 16 In Canada: Handscraft Tools, Ltd., Hermant Bidg., Toronto *Reg. U. S. Fat. Of.



Far from Broadway ... Arthur Hammerstein Keeps Young ... and Busy ... in his Atlas Equipped Shop

With the beautiful melodies of his 31 musical triumphs still echoing, famed producer Arthur Hammerstein, at 73, continues an active vigorous life on his 300 acre dairy farm near Chicago.

His love of tools carries over from boyhood days in his father's shop. Now he is happiest in his Atlas-equipped workshop, repairing farm and home equipment and working on unique inventions, which include a non-clogging salt shaker soon to be sold nationally.

For practical relaxation after busy days, or an interesting hobby with future commercial possibilities, nothing quite compares with a home workshop. And you'll find Atlas industrial tools ideal for such a shop — compact, powerful, accurate, and low cost.

They help you master any machining need that develops as you repair home equipment or work on ambitious projects. Ask your Atlas distributor to give you the complete details about their many performance features.

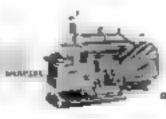
Free - "SUCCESS STORIES"

An interesting collection of photographs and stories of men who built businesses of their own with Atlas tools. Send for your capy today. Atlas Press Company, 255 North Pitcher St., Kalamazoo 13D, Michigan,

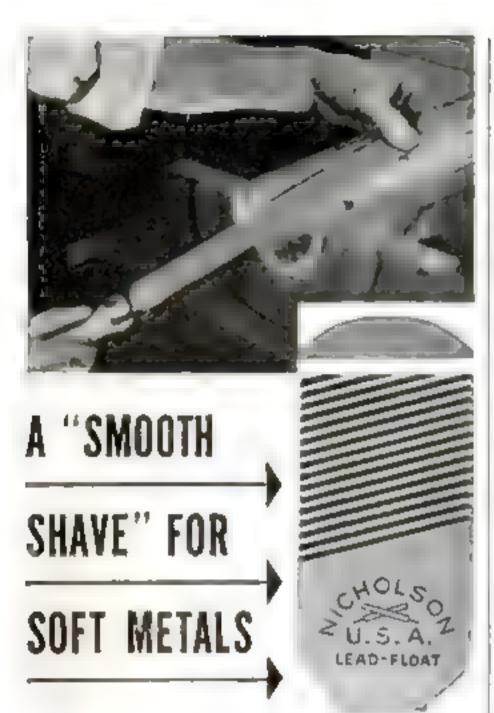


Atlas. 4 TOOL TEAM









Yes, the Nicholson or Black Diamond Lead Float File actually "shaves" thin shees from such extra-soft metals as lead and bubbitt. Its coarse, short-angle teeth or "blades" cut away stock rapidly under normal pressure. Yet the same file—used with a lighter touch—produces a smooth finish.

Lead Float files are made in both Flat (rectangular cross-section) and Half Round shapes. In the above illustration, the Half Round back of a Lead Float file is being used to smooth up the concave edge of a babbitted bearing. This shape is also useful in reaming lead-pipe fittings and finishing off solder joints.

Nicholson or Black Diamond Lead Float Files—both Flat and Half Round—are widely used by industrial plants and machine shops on soft bearings and moulded parts; and by plumbers and home craftsmen.

PARE - 49-PAGE BOOK -"FILE FILOSOPHY"



16 Asars St., Providence 1, R. L. (In Canada, Port Hape, Ont.)

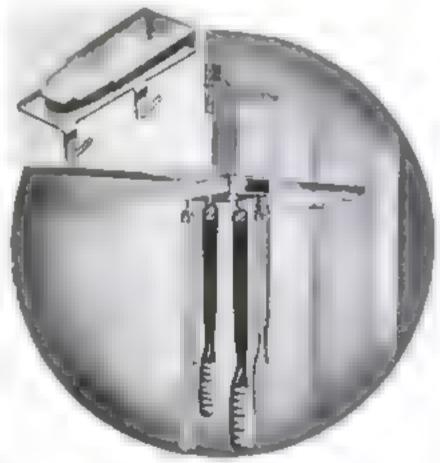


NICHOLSON FILES FOR EVERY PURPOSE



Solderless Connectors Stay Put

A KIT containing 325 assorted solderless connectors for electric wiring has been placed on the market by the Burndy Engineering Co., of New York City. The package holds a tool for installing the pure-copper joints. The connectors, which fit No. 10 to No. 20 wire, are constructed in one piece and will not come loose when they are fastened to a conductor.



Novel Toothbrush Holder

THOSE who like the family toothbrushes kept out of sight should be interested in the new Prim holder (inset at left, above). The aluminum clip is designed to ship over a shelf inside the medicine cabinet, as shown above. The holder has four hooks on its underside and a flat top.



MASTINGS MANUFACTURING CO. - MASTINGS, MICHIGAN Hastings Ltd., Toronto

PISTON RINGS

TOUGH ON OH-PUMPING GENTLE ON CYLINDER WALLS



MOTOR RYTHM

and start faster in cold weather!

Pour a pint of Motor Rythm into your crankcase now—add a pint with every oil change and be sure of fast, easy starting on the coldest day! Save your battery, save your car, save your temper—a touch on the starter and the coldest motor springs to life with Motor Rythm in the crankcase! Ask for Motor Rythm at your garage or service station. R. M. Hollingshead Corporation, Camden, N. J.; Toronto, Canada.





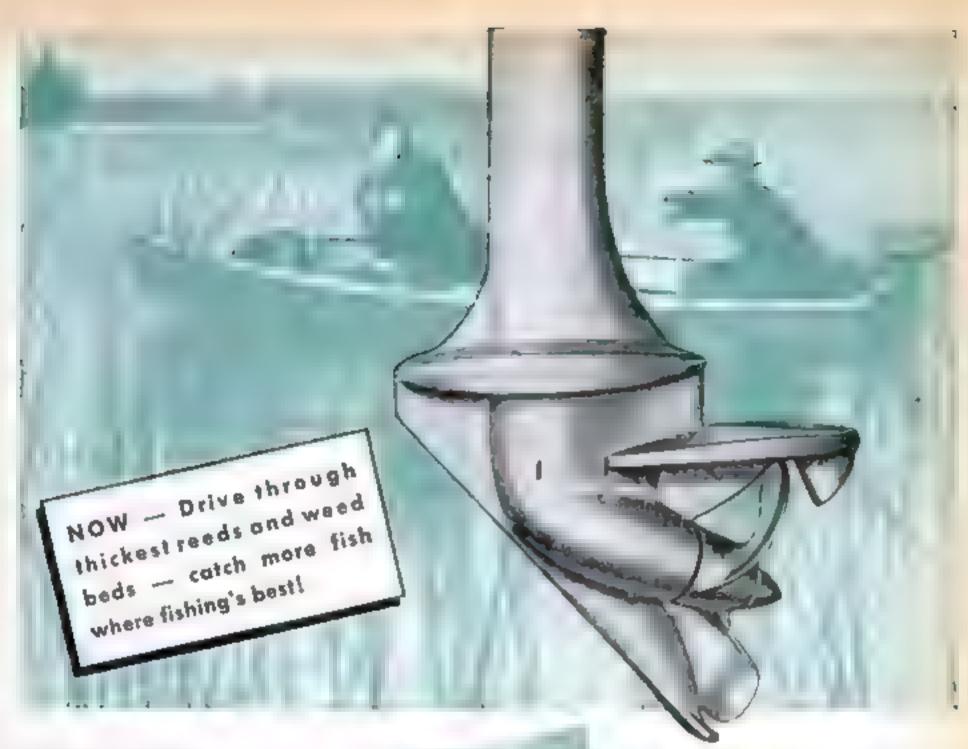
Speeds Linear Conversions

Time lost translating fractions of an inch into decimals, or inches into millimeters, can be cut by the Calculaide converter. With a range from 0 to 100 mm., its decimal equivalents are graduated at .001 inch, its metric ones at .1 mm. Besides linear equivalents, it carries corresponding gauge numbers from No. 3 through No. 30, plus drill numbers from No. 1 through No. 60.



"Cooking" Chemicals for Tubes

IN THE pot above, chemicals are being cooked in a steam-heated, glass-lined kettle before being converted into screens for cathode-ray tubes. To assure purity, the North American Philips Co. phosphor laboratory in which the pot is used has an electrostatic precipitation system to purify the air.



Evinrude announces the revolutionary new

Weedless Drive

Now you can enjoy a new "freedom of the water" Drive full power, it is stop, through thickest reeds or dense carpets of water hyacinth or lotus, Sash cont. dently through water growths you would not dream of tackling with any conventional drive. Go where you wish . . . catch more fish where histing's best!

Fully tested and amazingly effective the

WFFDIFSS DRIVE is the result of long experiment to perfect a drive equally efficient in weeds and in open mater. Tremendously rugged . . . built to take the banging over rocks and dead heads. Equipped with new type propeller slip clutch that practically eliminates need for shear pin replacement. The WFEDLESS DRIVE is now standard on two of Evintode's most popular light motors, Sportsman and Sportwin See your Eventude dealer — look for his name in your classified telephone directory under "Outboard Motors."

The Evintude catalog is free—send for your copy today,



WURKSHUP WISDUM

Laminating waste stock for turning

MAKE use of your waste stock by laminating scrap pieces with CASCAMITE, because it's atrong, stain-free, and highly water-resistant.



To laminate waste stock

Choose pieces of stock to roughly approximate finished size and shape. Plane surfaces to be glued so that they are perfectly smooth. Spread a thin film of CASCAMITE on the surfaces to be glued. Clamp and let set (at 70°F, or warmer) until glue is hard.

CASCAMITE is also recommended for laminating stock for table and chair legs, banisters, deep wooden bowls—wherever large dimensions discourage use of solid stock.

A "cinch" you'll prefer—CASCAMITE

Easy to mix. Just add CASCAMITE to cold water and stir.

Strong, CASCAMITE forms a bond stronger than the wood itself.

Thrifty too! Mix CASCAMITE as you need it. No waste.

Get CASCAMITE urea-resin glue—and CASCO, the standard case in household repair glue, at your hardware store in 10¢, 25¢, and larger sizes. For outdoor and boat work, use CASCOPHEN, the new, completely durable, waterproof resorcinol-resin glue.

PREE GLUING GUIDE containing complete gluing directions plus helpful hints for house-hold repairs. Free on request. Address a post card to Casein Company of America.

Dept. FE-37 350 Madison Avenue, New York 17, N. Y.

CASCAMITE

Dry Powder Urea Resin Glue



You'll be attained by the sentetional new mortur-like repair comment, that's so easy to use. Mixed only with water, X-Pandotite can be applied with a putty knife, or table haife. It's the permanent fixer for cracks, joints, loose fixtures, tile and 1001 other things that need repairing. For enchoring and molding purposes: X-Pandotite can be colored before using: stained or painted after hardening.

A Production would at feeding bords are and paint more at 150 for a p. th. names 600 for a rest [h. con.

It was direct can't supply much Mr. for a 10 on \$1.00 for 15 fbs. to the 3. Panels space 1 15 Thorn beats for Long fident spec N. Y. The A. Panelsson and became prepared.

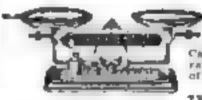
X-PANDOTITE

CUTTING TOOLS

A catalog of cutting tools and supplies made available for the first time—is yours for the esking Hard-to-get cutting tools and supplies—hundreds of them—are in our available stock. Send Jac and receive this wonderful catalog immediately by return mail

or Phone

EASTERN TOOL & SUPPLY COMPANY 176 Grand Street, New York 12, N. Y. Canal 6-3749



With sither Metric or Av. \$6.00 olrdupois Weights

Chiefog with 3000 (I perceitops of laborators Access us sent for \$, 00 Catalog of 100 ac collect books 0 cents LABORATORY MATCHIALS CO. 7317 Vincenses Ave. Colcans 21 11.

"THE FORD" MOTOR

-1 1/4 Horse Power Gasoline Air cooled 4-cycle-



Designed for Lawamowers Scholers this Air Colopressors Boats Garden Tracture and Interest Livity Use, Lightweight Alum num silve repatraction I be an aircraft engine easy starting and long life. This motor includes the famous Thiotson cartureier Bendus Scholers are especially pitted muster as a caper gasoline iter tank of Tested and Seady to Jun. Puty Gustanteed.

\$81.50

P D.B Pactory Direct To You.

Distributors Inquiries invited.

THE CAUFFIEL MOTOR ENGINEERING CO.

312 South St. Clair \$1.

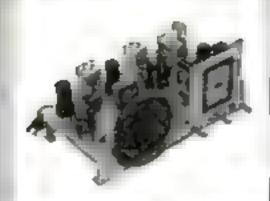
Talade, Ohle



June in: TEXACO STAR THEATRE presents the Eddie Brocken show every Sunday night.

METROPOLITAN OPERA broodcasts every Saturday afternoon, See newspapers for time and stations.

۲



NEW BARGAINS AT NEWARK



e Mull Orders Filled Frant Either New York Or Chiange

BUILD YOUR OWN RADIO 7th Easy WITH THESE NEW KITS

Here they are, beginners! Two new kits. Build your own radio in jug time. It's simple with these special Meissner John.

• 5 tube superhel, all stations on broadcast band. Your favorite programs ever a receiver you have built yourself COMPLETE

6 tube superhet, gets Europe and Americal
A real jab, but easy to build.
Fun, experience galore: COMPLETE
Cobinet

55.05 auto.

Both sets are complete, sasy to build,
fine performers
These as well as
many other burgains are available
now at Newark
Write for our Super
Bargain Bulletins.
Visit our stores, talk
"shop" with our
personnel, and see
some great radio
and siectronic
equipment

NEW YORK Offices & Worshould 247 W.55A.St. N.Y.19



New York City Stores: 115-17 W. 45th St. & 212 Fulton St.

85



REPAIRS

FURNITURE, TOYS

... also broken china, glassware, torn luggage and books. This handy adhesive is waterproof, transparent and flexible. Get a tube today!





Decorate plastics (illustrated) in any form . . . trays, boxes, bracelets, etc. Tool leather, emboss metals, engrave jewelry, cut out cardboard signs; with a Vibro-Tool it's easy to make varied types of unusual gifts. Yibre-Teel with Engraving Reedle \$7.50

(IIO V. AC 60 Cycles)

Tool and 22 accessories, with sharpening stone, in handsome hinged hardwood box, com-\$1650 plate for only . . . 1650 SEE YOUR DEALER or Order Direct



BURGEST BATTERY COMPANY



may lie in a hobby:
Try woodworking with
Delta Homecraft* Power Tools

Delta tools are typical products of the American way of deltage business. In America we use tools to create more and better things at lower cost than in any other country, and in this way provide better living — for only as people work topicaer to produce more can they have more to ruppy

"Happiness Herald"

- a complete introduction to woodworking hobby

Free! Pages of beloful information showing how to get started in woodworking and what to make. Pictures of interesting shops and projects. Tips on selection of tools. Send the coupon now.

Plans for an easy-to-make Dolf House

Complete plans and instructions for making the extractive doll house thown above. Plans — easy to follow — include clear photographs and detailed drawings, with a full-mand sectional view. Send coupon today for Plan No. 4649. Only \$1.00.

Call it contentment — peace-of-mind —escape. A lot of folks are finding it in the popular woodworking bobby.

You get a thrill when you discover and use the inborn skill of your hands. Medical men say manual activity is good for you.

You find that your hobby draws the family closer together, as you share in this fun.

There's nothing hard about wood-working, especially when you use Delta Homecraft Power Tools.
These famous tools are known the country over for their

Trade Mach Mog. U.S. Pat. Of. superb quality, which is another way of saying that they are so accurate, so dependable, so safe that even a beginner can turn out attractive projects to be proud of.

When Delta tools become available in quantity, you can see for yourself why they are first choice in so many home shops, as well as in schools and industrial plants.

Get acquainted with your Delta dealer, let him help you plan. And send the coupon today for free copy of "Happiness Herald," the introduction to woodworking.

DELTA

Beita Manufacturing Biv. Reckwell Monufacturing Co. Milwoukee 1, Wisconsin





More Power—More Capacity -More Flexibility than any other homeshop handgrinder!

You " at three them in your workshop handgrinder — PUW , (APACITY, FLEXIBILITY Look now you get those in the New Dumors Duplex! Powered with the famous Dumors gotor, full 1/14 HP, to handle beavy jobs. Employed with 16 " chuck for extra capacity Practical attachments to context matently for beach, bothe, and dexible-shaft work. Think what you can do with this extra power, capacity, and first what you can do with this extra power, but or, faster work — two the fun — and at no highest better than an ordinary hadnerinder! higher price than an ordinary hamorizeder

Full Power to Handle 1/4" Shank Tools

You can do a countless variety of jobs with the Hupley-

handing, sharpening, g inding, sawing, and many more. Its clinick taken (100), with the first and 5, 12 whank — ordinary handstructure than by and to the first and the f 1/14 HP motor has pleady of power for heavier John, Long life heatings maractes trouble free service.





The Deluze Dupler Crinder Ett. (illustrated shows) includes the (illustrated above) includes the Duples Orinder and 27 different tools and accessoriat, packed in a permatient case of handsome polished wood. Complete as described — 327 50. Standard, 8 accessory kit, without case—319 75. With a simple, easy to use attachment your Dupley becomes a flex ble-shaft tool. Write for information on this kit, and other attachments which convert the Dupley late a lathe- and beach-prinder.

grinder.

Money-Back Guaruntus — 10-Day Trial
Take advantage of our 10 day Trial Money Back Guarantee
— prove to vourself that the Duplex Grinder is the best
hobby tool value on the market today Production is still
too limited to stock your dealer but while the supply lasts,
we can accept direct orders for immediate delivery.

Tour out and mail this coupon today!

THE	DUMORE	COMPANY,	Dest. C-8	Z, Stacine,	Winspelie

Please send' ane.

be Deluxe Dumore Duplex Grander Kit Price \$37.50 One Standard Dumure Duplex

Enciosed is my check (or money order) fgr \$-----

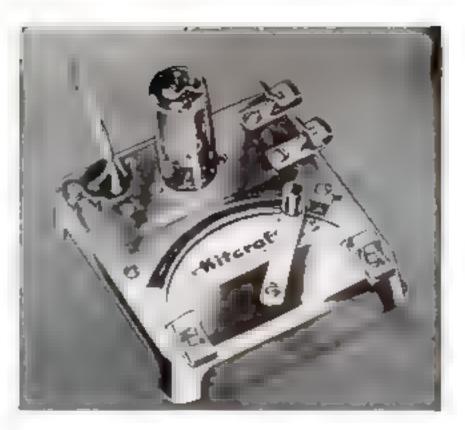
Please ship C.O D. pius postage And instructs

If not completely satisfied with my Duplex, I can return it within 10 days for a complete refund of the purchase price,

Please send complete information on the Dumore Dupley. Grinder.

Name.

Etrus Address



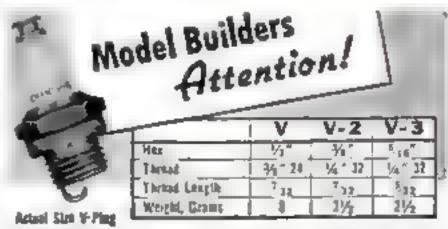
Single-Tube Radio Set

For youngsters who want their own radios, Luco Products, Inc., of Los Angeles, has designed Kitcraft Model 200, a one-tube detector and amplifier set. The radio is built around a miniature 1L-4 high "mu" pentode tube and will operate on a single cell for the filament supply and from 22% to 90 volts for "B" supply.

High School Photo Contest Offers \$3,500 in Awards

Prizzes totaling \$3,500 will be distributed in five classes of competition in Eastman Kodak Company's second annual National High School Photographic contests, which will open Feb. 15 and run through May 15.

Ninth through twelfth-grade students of public, private and parochial schools are eligible. Only black-and-white pictures taken since May 15, 1946, will be accepted.



Champion spark plugs for model gas engines give the same dependable performance as regular Champions. Sillment sealed. Sillimanity insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

CHAMPION

SPARK PLUG COMPANY . TOLEDO 1, OHIO

Dependante MDIOM





FOLLOW THE EXPERTS

DEMAND DEPENDABLE CHAMPIONS FOR YOUR CAR

The reason why Champion is America's favorite spark plug is because of better performance and greater dependability. Proof of this is in the continuing use of Champions by those who seek and win championship events. A current outstanding example is the 1946 AAA National Championship won by Ted Horn, master mechanic, master race driver. Champion Spark Plug Company, Toledo 1, Ohio.

Listen to the CHAMPION ROLL CALL, Herry Wisner's fost sportscost every Friday algels, 9:55 EST over the ABC network.

"Hawaiian Wigglers Get Results!"

"Dear Fred:

"The enclosed photo shows 18 bass and one crappie we caught on your No. 2 Hawaiian Wigglers from Lake Blackshear near Cordele, Georgia, The bass weighed from one to three pounds and were taken on opening day. In the picture left to right—Crompton Blankenship, myself and Hubie Leftwich, All of us enjoy using Hawaiian Wigglers, They sure get results,"—Franklin Martin, Marietta, Georgia.

Pranklin Martin and party.

Write for Free Catalog

Contains many interesting letters and photographs of catches made with Hawaiian Wiggiers, Jitterbuk my famous surface but and my new Hula Dancers.

FRED ARBOGAST & CO., 1702 W. North St., Akron 8, O.

No. 2 Shallow Running Hawaiian Wiggler—\$1,10



When you want to fix things fast ... be sure to get Weldwood Glue. It's tremendously strong ... waterproof and rot-proof. Easy to apply ... quick to dry ... stain-free and permanent. At hardware stores, chain stores and lumber dealers!

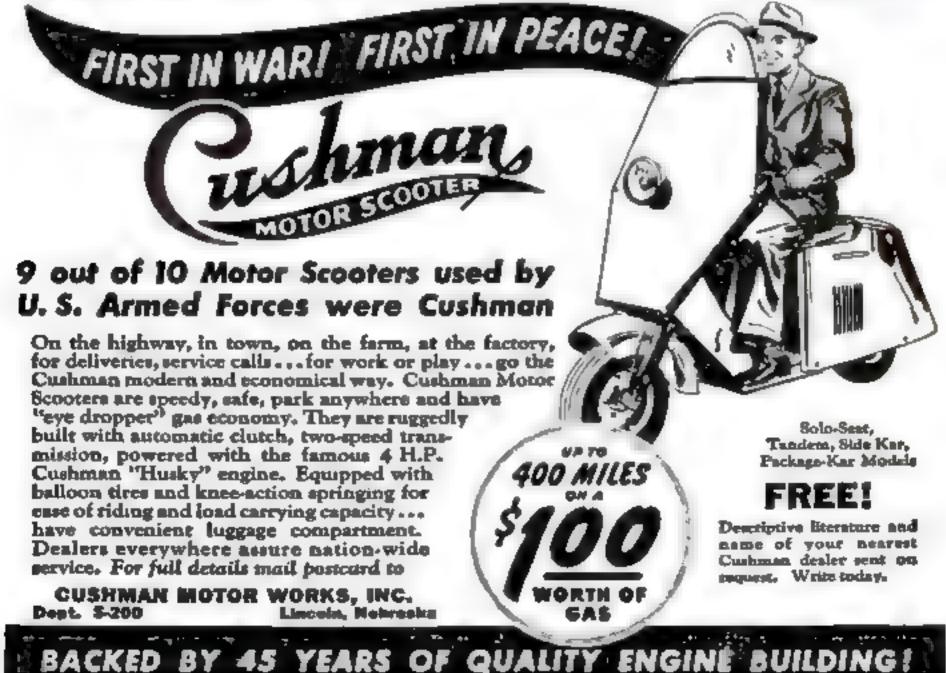


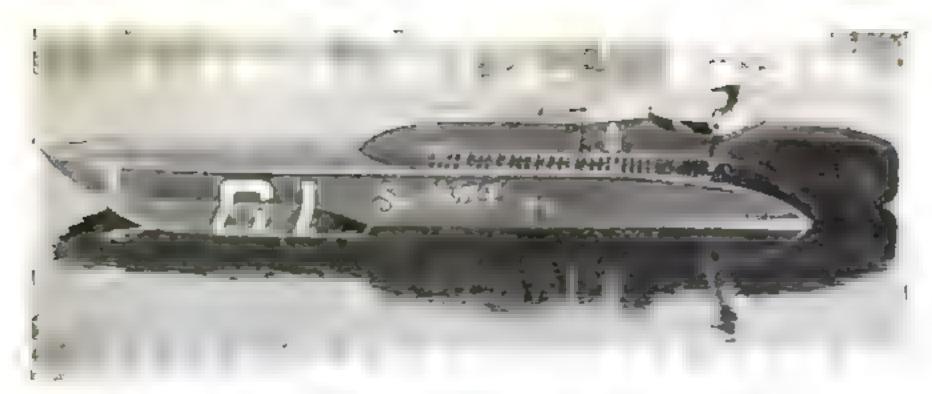
WELDWOOD
PLASTIC RESIN
WATERPROOF GLUE

UNITED STATES PLYWOOD COMPORATION, NEW YORK 18, N Y.

238 SCIENCE







Bus Engine Powers Viking Cup Race Winner

BEFORE L. J. Fageol, president of the Twin Coach Company, put a Twin Coach engine in his speedboat, the power unit, primarily used on buses, had been producing about 180 hp, at 2,800 r.p.in.

Fageol knew the engine was built to do better, so when he installed it in his speed-boat So-long Jr, he souped it up with dual earburetion and helped it along with a racing, camshaft and a V-type marine drive. As a result, he got 275 hp. at 4,000

r.p.m. This was enough to plane his craft over the water at 72 in p.h. to win the Viking Cup races on the closed two-and-ahalf rule New Martinsville, W. Va., course, He hit 100 m.p.h. in the stretches

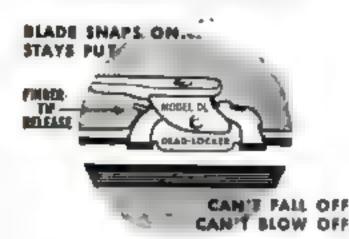
The Twin Coach engine's speed was five in p.h. Laster than that with which Guy Lombardo, band leader, won the Gold Cup races in Detroit. Fageol plans to give Solong Ir. a try at a world's speedboat record on Salton Sea, in California.





ANCO RAIN-MASTER

"Dead - Locker"
WINDSHIELD WIPER



(A war-born invention—by ANCO—first)
for military sircraft—new for your car.)

GAS-PUMP MAN!

He's doing the best he can. Sure, he knows how dangerous it is for you to drive your car... in stormy weather... with your dull old windshield wipers that smear and smear. He'd gladly put on for you quickly a pair of keen new ANCO RAIN-MASTER Wiper Blades and Arms. He has them—Newest Models! But he forgets to remind you? Too busy? You can't shoot him for that!



After all, it's your car to protect. So you remind him. Get RAIN-MASTERS ... patented features... original equipment on many makes of high grade cars and trucks ... used in war on our fighting tanks and trucks and ships and hombers too... because ANCO RAIN-MASTERS clean quicker, clean cleaner... last longer. May save you a costly smashup.

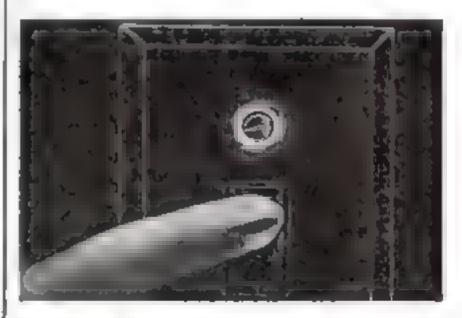
Ask for RAIN-MASTER Windshield Wiper Arms and Blades next time you buy gas.

THE ANDERSON COMPANY Established 1918 GARY, INDIANA



Decorative Window Frame

AN INTERIOR window covering that permits a wide variety of decorative effects is produced by Robb-Hill, Inc., of New York City. The wooden Windo-Frame, which is sold unpainted, is adjustable in width from 39 to 45 inches and is 65 inches long.



Helps Find Things in the Dark

Easily attached to switches, door knobs or other objects, the Radi-Glo button made by the Lustrolite-Cleveland Corp., of Cleveland, eliminates fumbling around in the dark. A small plastic ring, it contains a sealed band of glowing material.

AMAZING NEW SAFE MAGNETIC SAW!

READY FOR IMMEDIATE DELIVERY!

Madel No. 1900

SYNGRO DELUXE JIG SAW

For HOBBYISTS, CRAFTSMEN and LIGHT PRODUCTION

\$17.50

FOR FACTORY

Shog Wt 13 Bu. Prices sightly higher in foreign countries



NO MOTOR NEEDED-JUST PLUG IN! PORTABLE... SAFE... CUTS CLEAN AND SMOOTH-NO SANDING NECESSARYI

ANNOUNCING a remarkable PATENTED, MAGNETIC Jig Saw—better performing, better-quality than famous PRE WAR MANCRON—now ready for immediate shipment anywhere: SYNCHO peads no belts, no gears no oiling. No motor to buy, This high-speed, short stroke action, and freedom from belts, makes SYNCRO so safe even small boys and girls may operate it. Out this husky, powerful, 18 pound saw . . . so sastly portable——you can use it anywhere—even on the kitchen table——so smooth-cutting no sanding is necessary! Cuts intricate designs on % soft wood, 1/2 plywood and thin

ner hardwoods pinstice thin metals. Leaves no ragged undersides on plywood or heavy cardboard. The rapid action blade cuts to the center of a 27° circle. MENCHO is a rugged powerful power tool for exceptionally high quality work but to not for ordinary lumber cutting. Ideal for hobbyists, craftsmen, light production. Perfect for models, displays, puzzles, lineys subjousties, toys, marquetry, games, what nots, etc. Order yours now on our 10 Days Money Back Trial offer—enjoy a Histions of use!



PORTABLE SAFERT NAW (2)
PORTABLE SAME IN SECON
Cycle A L 110-130 voit was not
let. 13 NO HOTATING MOTHER
NEST NO SINCIPAL SAME corts need
magner of power unit transmits A C
magnetic impulses to armeters dis
phrages hower preparered to saw
frade COIL come no axa the No.
19 insusated supper were conmissing toped impregnated based
maranteed not to lairn out! MAGNET COIK come no 38 agers of
meral DIAPHINA M of spring steel
hear treated under special processes
appeared on I 1 V Krubber mount
and cartridges 40 14 4 m
STROKES PER MINUTES (3 NO
1601 THE ATTNOS 18 ROTATING
PA TES OLING (7 TABLE TOP
10" x 10" a heavy this duca is
all of die conting to thick ribbed
have Surface process for easy

a heavy du shie die cass of a heavy du shie die cass of the case o

ORDER on 10 DAYS TRIAL!

the you may acree with complete confidence, read this SYNIPO TRINI OFFICE When you get your any plan it you may do eye a A T 110 fee write out et und new acreed up to instruc-

them Then, if it does not enterly tenperfectly is every may return I post paid with a long and dolvery date and me will refund your \$1. W prempt by without questioning Order new

HOW TO ORDER-DO IT NOW!

Mail Coupon with Postal Note. Maney Order or check for only 17 50 place Parce Post or Express corrying charges or send \$17 50 mily and ar will this saw callect for Parce Post or Express carrying charges only. Specify type of delay

ery on Compact, Shipping weight purked in the Harry Act promptly worder-we I able some des moles have tel (Na tompferty COD actors accepted) Add distribute pales in any price



SAW CORPORATION

DEPT. 8-27 ROCHESTER, MICHIGAN

EXPORT ADDRESS: 120 WALL ST., M. Y. CITY WORLD'S LARGEST MAKERS OF ELECTRIC ING SAWS

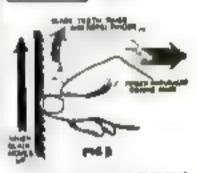
SAFEST!

the lang stacks in the language of the stacks of the stack of the stac



Complete

With cord,



THERE

"Family Sawi"

Power Saw ordered from you in 1940 in still

sawing mertly away My son (then 51 has used it in the attic kitchen,

his room in

shop, I use it too We never worry about accidents due to its Misgrotte Safety Stroke feature it strulys family asy "

ly a family saw "
Mr B H 5mi h
Reature Idaho

The Syncre

SAW CORPORATION, Dept. 8-27, ROCHESTER, MICHIGAN

(Enwert Address: 120 Watt St., N. Y. City)

concerned Here's By order for the SYN (1) MARNETIC JIC SAW Model No 2004 Show We packed 18 lbs \$17.30 ft in Factory Presse send (f complete with white the cable and plug 3 blades on your to late Money Sack Trial fier I concern 8 2 50 plus sinks as we may not plug any payment Please white saw

* Express Charges rollers or * Patrel Posts charges rollers

* Express for which 2 end one on exten 5

Patrel Post for which I epclass an extrast

MAME

2T 4 NO.

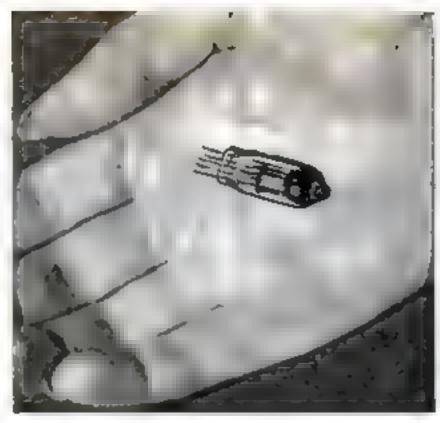
City STATE

E t enclose up money hand FREE STRONG CHROWAR



One-Hand Juice Squeezer

You can squeeze all the juice out of an orange with one hand tied behind your back with the new Juice-All extractor. The halved fruit is placed inside the cast-aluminum bowl and one downward stroke on the handle forces out the juice, which can then be poured from the lip on either side.



Tiny Tube for Hearing Aids

ONLY X-inch long and X-inch wide, tubes like this powered such war devices as walkie-talkies and mine detectors. Now their maker, Sonotone, is using them in hearing devices. Three of them go into Sonotone's latest instrument, which can be used for either low- or high-powered amplification.

JOHNSON is the outboard motor that leaves its wake around the world! Wherever men use boats the Johnson Ses-Horse is a familiar sight—because it is DEPENDable.

It offers users the simplicity and reliability of twin cylinder construction. It has all features that contribute to brilliant per-

formance. Remember, outboard motoring's great improvements (Alternate Firing, Reverse, Dual Carburetion and others) are JOHNSON developments.

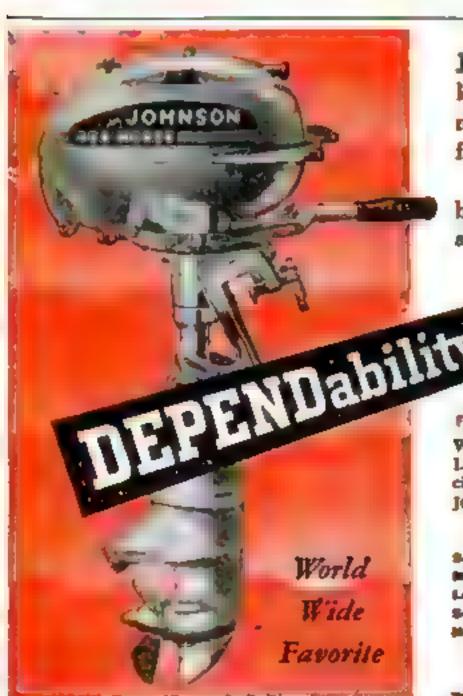
FREE HANDY CHARTS New Describes the 1947 line.
Write for R. See your Johnson dealer about delivery.
Look for his name under "Outboard Motors" in your classified phone book

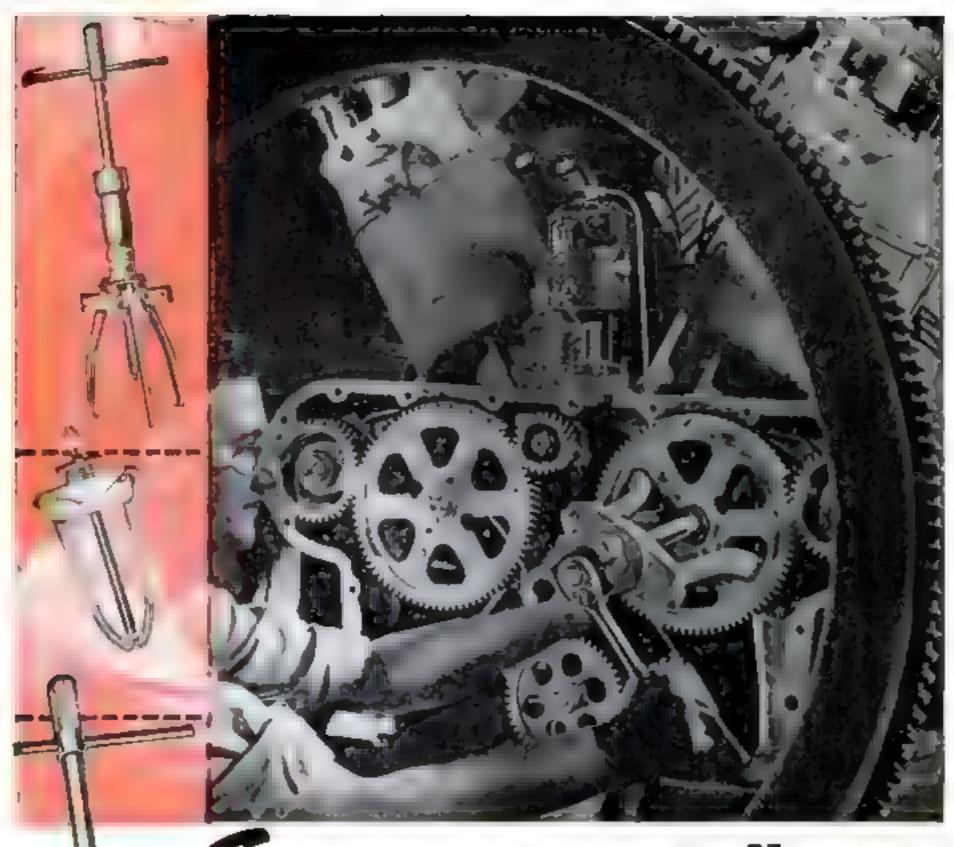
JOHNSON MOTORS, 500 Pershing Rd., Waukegan, El,

1947 SEA-HORSE MODELS

ANTH P ratings above are O B.C Certified Brake Horsepayer at 4000 r. p. m.,

THERE IS NO SUBSTITUTE FOR EXPERIENCE





Snap-on Gear Pullers

give you safe, uniform power over entire range

On the testing floor—in maintenance operations—wherever there is a need for gear pullers, Snap-ons are favored by nien who know good tools. There are four definite reasons for this popularity. (1) Snap ons have more. I sking power for added safety. (2) They give you a 'tip less pull that prevents

binding (3) You enjoy smooth unitorm power for easy pulling over the entire range (4) Snapon pullers are available in a wide range of types and sizes.

You'll like the comfortable, wellbalanced feel of Snap on pullers, They have the ruggedness and stamina that make easy jobs out of the tough ones.

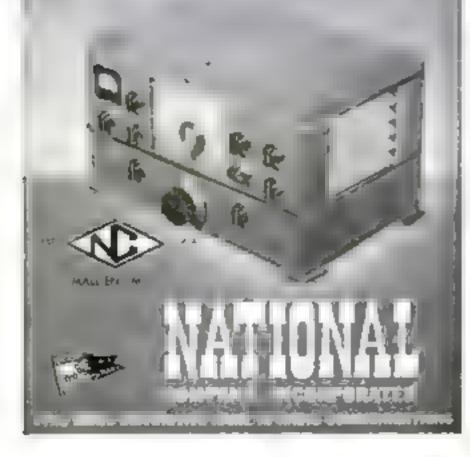
Snap-on pollers are part of a complete line of 4 000 tools available through Snap on 8 nationwide, direct to user tool service. Write for free catalog,



SNAP-ON TOOLS CORPORATION - 8060-B 28th Avenue, Kenosha, Wisconsin



Flick the switch and turn the d'al in stantly you'll begin to sense how the 'Three R's' combine in the 12 tube National NC-2-400 to bring you truly matchless performance Range pick up station haf a world away Reliability . . . proved by the record of National sels on three fourths of the Novy's warships Research never ending, to bring you at last a thrill ing new experience in radio reception Hear the NC-2-40D for yoursef. Write today for name of your nearest dealer



 A pliable, plastic weather-stripping, casily, quickly applied to windows, doors, baseboards. Stops expensive heat leaks. Keeps out dust and dirt.

Just press into place. Use inside or outside Can be painted. Mortite does not shrink crack. Also plugs cracks around drainboards. bathtube, etc.

Roll covers about 80 feet. enough for 5 windows.



AT HARDWARE, PAINT, DEPT. STORES AND LUMBER YARDS

Higher west of flocking. and Canade

Ask for Mortite Epokieti J. W. MORTELL CO. 534 Burch St., Kankakee, Hilaole

Stardy rubber lived precision made pressed ates) wheele with cod ensure fluish Ready I use as on threaded at both ends Actor auto sampled (Indee 4" Wheels with solid suspen times 4" Wheels, 's" bearing fired Disc 4" Wheels, 's" bearing fired Disc

Best postpejd in U. S. on receipt of price CIRCLE METAL MANUPACTURING COMPANY





4234-A Lincoln Ave., Chicago 18 Ninois



COMPLETE WITH 34 A CCESSORIES IN FITTED STEEL CASE

> \$31.75 Value If Perchased Separately

CASCO ELECTRI-CRAFT TOOL KIT

explusive features

then any other tool,

Works Wand, Motal, Glass, Plastics

CASCO PRODUCTS CORPORATION, BRIDGEPORT 2, CONN.

START HOME MAIL ORDER BUSINESS

Start small—grow big, Amazing new course shows you the way Write today for full particulars. No obligation. BELFORT (Dept. 0) Engineering Bidg., Chicago S. IN.



1272 Lalayatta Ave., Bay City, Mich.



STOP FUEL AND OIL LOSSES; GET BURD "GRAF-FLOX" PISTON RINGS

Budget-conscious car owners find added pleasure in driving, after a re-ring jab with Burd "Graf-Flox" Piston Rings . . . they appreciate the worthwhile savings of gas and ail. There's a bonus of fun from hearing the sweet sound of a smooth running engine, too . . . and from feeling the instant response at the touch of the accelerator. Try a set of Burd "Graf Flox" Piston Rings . . . they're quicket-seating, longer-lasting because they're made of electric-furnace Iron, precision finished and "Graf-Flox" treated Mail the





7he HUDSON TURBO GRINDER

SHARPENS Everything for Home and Shop

Simplest operation possible. Just attack to any ordinary faucet, turn on the water and the sensational patented thickock bribe jet impulier spins the wheel at more than 3,000 revolutions per minute—gimest twice the speed of a standard e actric motor. Adjustable to 10,000 APM, depending on water pressure ideal for the hondy man, housewife, habbyist, mechanic, farmer. Precision built, quality throughout. Super hard elican carbide wheel. Stainless steel that. Chrysler Ollife bearings increased ciling). All metal parts pleaming throms. Colorful vinylife tubing.

Sharpens linives, sciesors, shares, lower mowers, wood plantes, bits, chisals, eaces, hatches and all edged tools.

FULL MONEY BACK GUARANTEE See Your Hordware Dealer

HUDSON PRODUCTS CO.

4422 ST AUBIN AVENUE DETROIT 7, MICHIGAN

HUDSON	PRODUCTS :	CO.
4422 St. Avi	bis Ave., Detroi	17, Michigen

Enclosed is a \$8.95 [] check, [] money enter for which rish to me, postpaid, one Hudson Turbo Grinder with full instructions for use. I understand the Grinder corries a full, maney back guarantee.

Address										
Name of Ho	rdwork	Deal	uf .						*****	
City.						Shah	7511			
Address				-			٠. ش	÷=		
Note .			71		14				78.	



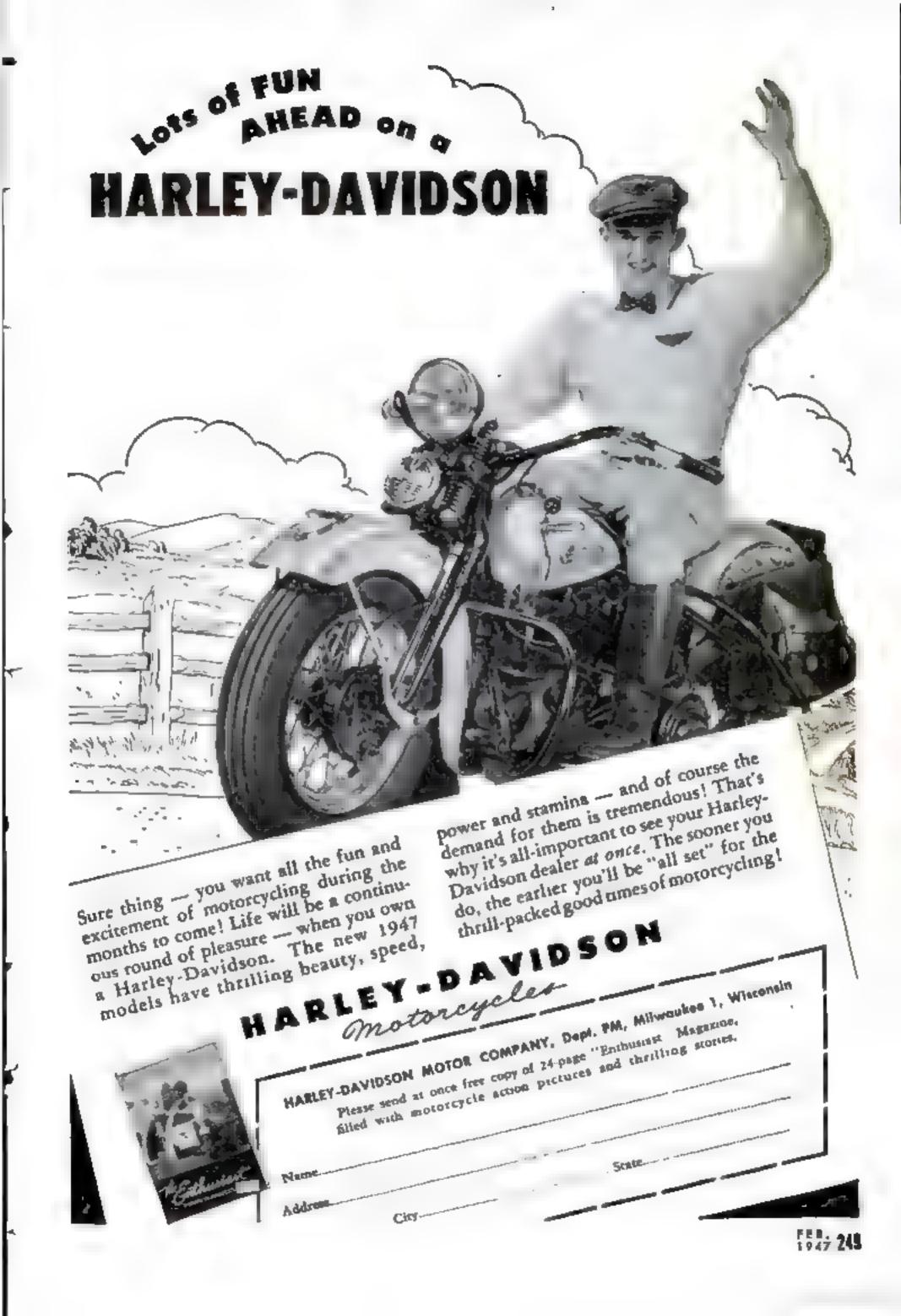
Electric Comforter Has Zipper

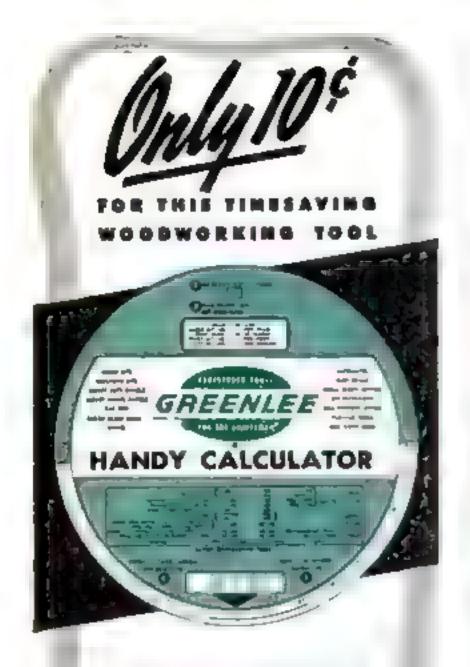
When the rayon satin cover of Westing-house's new electric comforter is ready for the dry cleaner, it can be removed by unzipping a 36-inch zipper at one end and untying several tapes that fasten it to the warming sheet it encloses. The warming liner is washable. The underside of the cover is made of slipproof spun-rayon faille. The control that sets the temperature for the electric comforter is housed in an ornamental box.



Radio for the Hard-of-Hearing

Two separate controls, one for a standard loudspeaker and another for listeners who are hard of hearing, are incorporated in the new Emerson table-model radio. A person with impaired hearing has only to plug into the radio and use a plastic ear receiver, which goes with the attachment. Volume can then be adjusted to the listener's wishes without interfering with the volume of the regular loudspeaker.





This sasy-roading GREENLEE HANDY CALCULATOR swiftly solves your wendworking problems. Just set the dials convert linear feet to board fest; get slope per foot in degrees; compare hardness, weights, shrinkage, warping and working ease of various woods. More, toobit sizes for head, body, thread of scraws, noil specifications, tool sharpening hints; protractor. 6" diameter, fits your tool kit Heavily varnished cardboard Special offer Order now, send 10¢ (not stamps) In next mail. Greenlee Tool Co., 2122 Columbia Ave., Rockford, III.



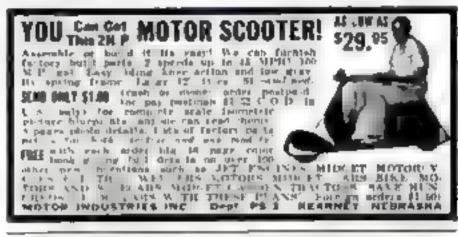


FIX IT YOURSELF!

You don't even have to be handy with tools . . . just get on O MALLEY FAUCET REPAIR SET . . . roud the simple directions . . . and in a few minutes you can cure your laucet of its messy, water-westing, nerve-devocating Drip-Drip-Drip. Costs loss than a deliar, depending on the size you require, wherever hardware is sold.

Edward O'Molley Yaive Co., Chicago 19

O MALLEY PROCET BEPAIR







A complete kit of abrasive wheels

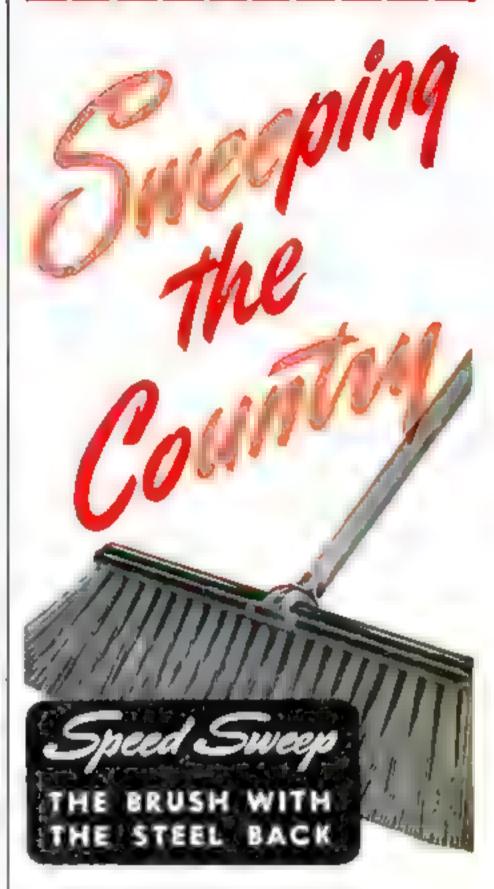
 Many sizes and grits. Each wheel is made of layers of abrasive cloth; you get a new surface simply by peeling off the old one. Exclusive Field construction assures flexibility for life of each wheel, Indispensable for deburring, removing tool marks, granding, polishing and lapping. Kit includes 184 wheels, 8 mandrels of standard sizes and chuck for 1/1" shaft bench granders. A real addition to professional or amateur work shop.

Price \$12.75 complete fob Dayton

FIELD ABRASIVE PECIALTY MANUFACTURING CO.

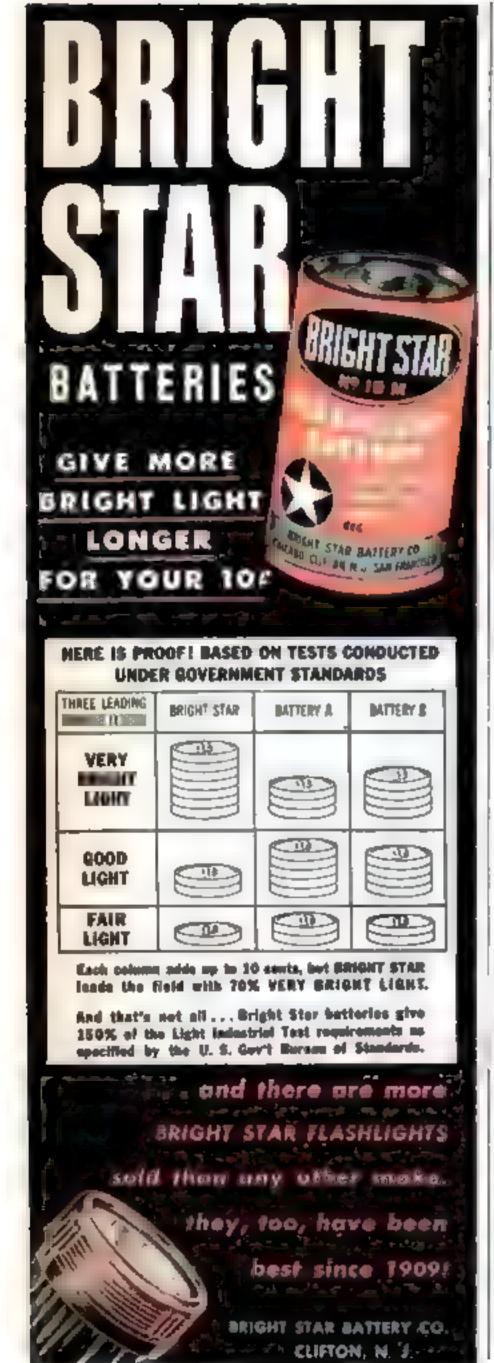
126 S. Ludlow St., Dayton 2, Ohio





Speed Sweep brushes are replacing old style brushes in thousands of factories, warehouses, and stores because they sweep faster, cleaner and easier. Speed Sweep brushes also outlast ordinary brushes 3 to 1. There is a Speed Sweep to meet every requirement. Write for styles, sizes and prices today.

Milwauhee Dustless Brush C 530 North \$2nd Street Milwaukee 3, Wis.	5.	
Please send me complete Speed Sweep brushes.	information	эрол(
Name		
NameAddress		



GREAT NEW TOOL!

The world-famous Mead Bandsander is ideal for home workshop Shour use! This remarkable machine use on quickly shapes sands, carves and made polishes wood, metal, plastes! Works equally well on lasido cutout openings or irregular outside edges. Gets at places no other can! Tiling table for bevelling, chamfering Bust-and-sweat proof top. Ball bearings. Saves time, labor, money on jobs in any home or industrial shop. Invaluable to home-craftsmen, makers of patterns, tools, dies, signs, costume jeweiry, castings, forgings ornaments, radio and electrical parts, stampings, etc. Voltage else like it. Sold on 5 Day Trial, money back guarantee, Curcular Free!



Cuta Paul and
Circan
Banka Pilitana,
Banka in a final
Filitana
THE MACHINE THAT

AMAZIED THE EXPERISE

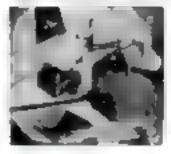


WRITE for FREE Circular

Send for free details on "the machine that amaied the experts" high a postrard today for Cleouser, suspensingly law price Horry!

MEAD SPECIALTIES CO. 4114 N. Ress Ave., Dept. 227 Chicago 41, 111.

Sand Casting—Forging—Heat Treating—Case Hardening BRONZE FOUNDRY



is estim available in fimited quantity without priority Orders filed in sequence at received. INVENTORS-SCHOOLS-ORAFTSMEN use POUNDRYETTE for making castings quickly for new inventions, for instruction, and general purpose Order now for early delivery. Three sizes are available capable of making brooks castings of 1 y 1 and 6 pounds weight, aluminum, copper brans, etc. Domestic gas supply and 110 volt AC or DC energy required for operation. Write for circular

RAMSAS CITY SPECIALTIES CO. Box 5022, Dopt. S-75 Kanasa City, Me.

ELECTRICITY Anywhere



On an Annalineengine driven Electric Plants supplyreliable, economical
electric service for
any use Portable
stationary or standby models. Water or
are cooled compact
and sugged.

A C 350 to 35 000 watts in all standard vultages and frequencies D C 600 to 10,000 watts 115 and 250 volts SATTERA CHARG-ERS 500 to 3 500 watts to 12, 24, 52 volts

Write for folder

D. W. ONAN & SONS INC.
1848 Revoluted Ave., Minnespolis 5, Minn.





"In your opinion, which make of handmy is highest on quality? Thousands of curpenters were asked that question. Three out of four replied, "Dission saws a high tribute undeed, for it comes from men who know saws best.

The reasons for this preference may be summed up in what one carpenter says, "You can't best a Disson for good, clean custons and long life."

Ask your Hardware Retailer for a fine looking, fine performing Duston Saw. Also ask him for a FREE copy of The Diston Saw, Tool and Fire Manual," or write to us direct.



HENRY DISSTON & SONS, INC. 218 Tacony, Philadelphia 35, Ps., U. S. A.

DISSTON The sew most

Genuine full-color KODACHROME PRINTS

Now available at new low quantity prices. Order through your Kodak dealer. EASTMAN KODAK CO., Rochester 4, N. Y.

Just the thing for the Home Work Shop, Hobby Shop, Bench Work Animated Displays, Light Produc-Animated Displays, Light Producof homes and shops. Sturdy, compact, (see dimensions), Case of heat treated sauminum. Gears. BAE 65 (British) Gear Bronze Worm of (British) Gent Bronze Worm of case hardened steel Timken Bearings throughout, Torque capacity 100 inch pounds. Available in 4 different assembles (shown below) and in these standard ratios

1144 (17)	PAUL WAR	MOTO FRANCE	
4-1	25-1	64-1	200-1
8-1	30-1	75-1	200-1
10-1	40-1	80-1	400-1
16-1	50-1	100-1	600- F
20-1	40-1	150-1	BOO-1

When ordering be sure to specify assembly and ratio required, Shopping weight in carton, 8 lbs. Full money back guarantee Prompt deliveries.

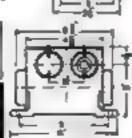


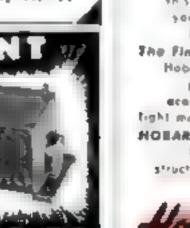


















Sove hundreds of dollers, burd your can gate he down Hobert are we dec You need on , a Hoba / generater a used duto engine and charty. With this portable gains as do se we der, you can go any place free book at le y you how Wile to date to

The finest A. C. Weider Ever Built Hobort A. C. Arc Weider for single phose I has Handles outs report economically - ideal for all types of fight metal work, line causes for details. HOBARF WELDING SCHOOL

and a dual and uction leapers instructors, low cost. Quo fied under G I, B I at Highes,

#	bari	Brothe	ire Co.,	Box P	-27
	Terry				
M.	Lorgest	Boriders	of Arc	Werder	ra *

	I'm Interested	In Hobert	Arc Welding, Sc	end
ì	my free book,	details on	tems checked.	
ï	D Car Da	and Miles Salves	TO Build 9	

-00			AA de Linda	r
	1	Ace	Welder	
 -	94	2015	AL STREET	

Suild Your Own Welding School

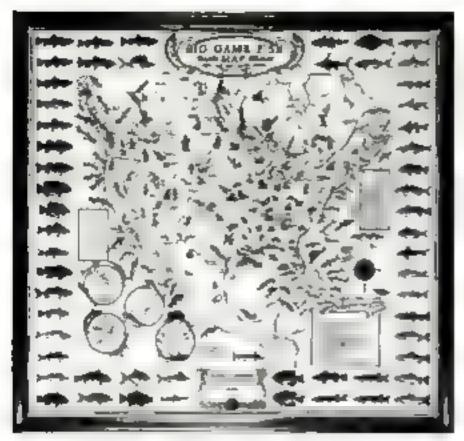
N	A	м	E		

ADDRESS.

Hebart Bres. Co., Box P-27,

A. C. Walder

Walders Yest



GAME FISH MAP

PRINTED IN A NATURAL COLORS—SHOWS 182 SPECIES

Here is the first authentic map of fishing Size 3 ft by 3 ft Lists all record fish-shows weight and where caught. Gorgoods print of benutiful color pointing and sultable for framing. Ideal for office

ONLY E.00

den club or lodge. Wonderful as a gift
Price only \$5.00 rolled in tube and
shipped prepaid. Also Map of Dogs \$7.50 and Game Birds
Map \$3.00. If your dealer cannot supply—order direct Dealers wanted

> THE SPORTSMAN'S MAP CO. 422 So. Dearborn St., Chicago 5, Ill.



MAKE A GOOD LIVING IN YOUR OWN BUSINGSSthurpening saws with the Forey Automatic Saw Piler It makes o'd saws out like new again. All hand saws. wiso band saws and cross cut circular saws can be fied on the ONE machine

THERE ARE HUNDREDS OF SAWS TO BE FILED IN your own neighborhood, used by Isrmers, curpenters. homes, schools, factories, etc. W. L. Terrant writes, "I

seft my old job sast September and in 10 months have fied 2 159 sawa. We have a lovely business worked up and cannot keep up with the work

Send for FREE PLAN

Shows how to start this steady cash business No superience needed No eyestrain. no can-Bend VEHI-DE. coupon today



FOLIT MANUFACTURING CO.

219-7 Paley Bidg., Minneapolis 13, Minnesota Bend Free Plan on Saw Filing business, no obligation

Name.

Address

POVVIAL SCIENCE

COR()DEX REMOVER

THE WAR-TIME MIRACLE LIQUID which cleaned millions of parts during war effort, CORODEX positively removes RUST and CORROSION regardless of depth, from iron, steel, brass, bronze, copper, chromium and nickel, Cleans tools, hardware, sports equipment, household utensils, etc., for a few cents a piece, No RUBBING or hard work.

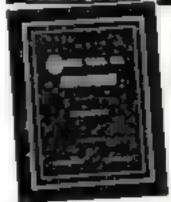
CORODEX IS GUARANTEED TO REMOVE RUST.

Valuable Manual of Rust Control free with order. On sale at all Sears Retail Stores in HARDWARE DEPTS. 50c and \$1.00 in Mid-West (Stightly higher elsewhere)

SEARS, ROEBUCK AND CO.

CHICAGO, ILLINOIS

(CarOdes; to made by Allied Products Co. | 1133 Newport Ave. Chicago)



Just off the press!--Every man who owns a workshop should have a copy of our new, up-to-the-minute, 200 page catalog of Machine Shop Equipment—the latest tools made by the biggest manufacturers in the U.S. Repiete with Illustrations, descriptions, prices, Prompt delivery on most tools listed in this book. Available at cost of printing—50c a copy—get visure today? Price of Catalog Returned on First Order over \$5.00. Sand Check or Money Order to

CENTER TOOL CO., 182 Centre Street, New York 13, N. Y.

Build Your Power Tools With OUR BALL BEARING ARBORS

New Departure seit inhelcating bearings 64 Th* do. also Inch between Bittured **東京教育を持ち** and coller

#11-94.98 PP 1234: Spinole #11 Plain Spinole #2.45

C5 % at 124 y apindle, housing 288 68.28 PP. C6 % (212) y spindle, housing 21428 55 25 PP. C8 1227 y spindle, housing 25 at 1 518 55 PP.

Landing Oracs. Tru-Bunning Alluminum Allay. 15 inth or Ry Agir. B technica. 13 50 PP 9 inth dis. 54 95 PP 10 inth dis. 50 PP. Fall stock of V besty and putters for immediate delivery PP. POLY PRODUCTS, 408 S. Chester Ave., Ct. 1, Dept. 52, Passions 5, Calif.

ideal for hobbyist or shop worker. this stordy useful bench makes home hand work a my Heavy top 2 large drawers Tool rack strong shelf bins for new and bots 59° ong 23° wide —36° bigh Shipped amateurions) FO B Phila factory, Check or money order. Money back if not satisfied



J. B. NOLAN, Box W. 5049 Walnut St., Philadelphia 39, Ps.



RADIO Builders, Experimenters



ORDER

HOM

588

Own this valuable Test Instrument!

ful value in an AC-DC Volt-Ohm-Milliammeter! This wide-coverage test unit with 2' moving-vane type meter reads: AC DC volts, 0-25-50-125-250; AC-DC ma., 0-50; Resistance, 0-100,000 ohms, 2400 ohms center scale; Capacitance, .05-15 mfd. Jacks provide range selection. In black baseline case with cord and plug. No. 84-306. Special Price . . . \$8.88

GET THESE HELPFUL ALLIED RADIO BOOKS!



Paratini-Resistance and Series
Corneltance Calculator No. 37-400 28

R-F Resonance and Cell Winding Calculator, No. 37-865 ... 28-6

ALLIED RADIO
123 W. Jackson Brel. - Ougl. 7-8-7 - Chicago 7



San your ALUEB Catalog for Everything in Radio



Bend 10c Today to Dept. J for Catalog of 45 Kits

MEIER BRASS & COPPER CO.

BRASS ROOS

For Home Work Shops

For use on model boats airplanes are keep a supply of these free-turning brass code on hand Kits evaluable for all size requirements.

NOW 93% MORE ENERGY, LONGER LIFE

Get the New "Eveready" Flashlight Batteries

The word "Everyody" to a registered trade-mark of Stational Carbon Co., Inc.

PLEXIGLAS

VERSATILE, CRYSTAL-CLEAR PLASTIC!

For hobbylists and use on home equipment

Transparent - Sparkling - Strong & Durable - Light-weight - Can be machined, sawed, drilled, threaded - Easily formed and molded - can be bent or twisted by band to almost any shape - Will not warp, craze or discolor in sun or weather - Bends light around corners, curves, angles - Perfect for lamp bases, bookends, tables candlesticks tableware, jewelry and novelties of all kinds!

SHEETS - RODS - TUBES - ODD SNAPES

ALSO dyes coments, buffing compounds. Franklia Plexigles Anti-Static Wax. Burnisher & Cleaner

CADILLAC PLASTIC COMPANY

659 West Bultimore

Detroit 2, Michigan



Smooth-On No. 1 has been a repair standby for over fifty years, sealing cracks, stopping leaks, tightening loose parts and fixtures. Get it in inexpensive 1¾-oz., 7-oz. or larger size at your hardware store. If they haven't it, write us.

FREE HANDROOK

40 pages, 170 diagrams. Simple instructions. Tested, short-cut repairs on bome, garage and shop equipment. Pocket size. Paste the coupon on a postcard and send for YOUR free copy today.



conservations Sign and Send New conservations are

SMOOTH-ON MFG. CO., Dopt. 588, 570 Communipow Ave., Jersey City 4, N. J., Please send me a Smooth-On Handback.

NAME

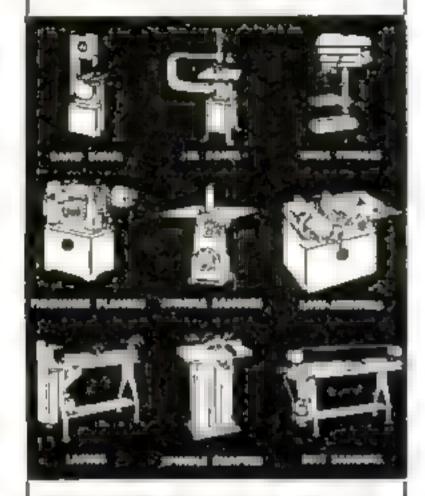
ADDRESS

1-47

Doit with SMOOTH-ON

BOICE-CRANE **POWER TOOLS**

for shop men and homecraftsmen.



Write for literature on this versatile, low-cost, sturdy line.

BOICE-CRANE COMPANY 944 Central Ave., Toledo 6, Ohio

BILLE BOOK

GAME SEPPLIES

Club Furniture - Counter Games - Punchboards -Magic Cards Readers, Read the backs - Inks - Daubs -Poker Chips - Tops Flats -Layrests - Game Benes.



K.C. CARD CO., 638 South Wahash Ave., Chicago 3, Ill.



SPEE-DOWL on wood the lathe or drill p.ess does the work Cast body tool steel blade SIZES 2 3, 4, 5 6, 7 and 8 16" (Bustrated at left) Only \$1 ca. Special—any 4 of above for \$3.50 compacts set of 7 for \$6. Also independent at res 8 to 20.16" (Bustrated at right) \$2.65 caps. SPEE-DOWL is Unconditionally Guaranteed Send postal note or check - we pay postage in North America FREE Literature.

JOHNS AUG. CORP. DEPT. 85

DUNILLEN, N. J.





d assumption throughout up a family hard and would working bands adorage for 2 dB . Includes grinds by Lymin ID' Street, Bulling mark-up facilities, Vinc. 8" Country Jav. 6. decelot Carb printed the contract of the BOY, of the provide few tool that

-describes I'l Laws took White 10041)

LEWIS MACHINE TOOL CO.

P. O. Our. 2446, Stn. L. Bopt, S. Lou Angeles 23, Calif.









PLUG-IN TEST LAMP

Tests Everything Electrical Speeds Up Trouble-Shooting

Used by Checkschung Mechanics Appliance Men, Radio Men paid Expensive ofters A ways ready) Pluge into say out of Tests continuity open circuits short circuits grounds sterile all motors endess electrics a pliances and other devices (sugaranced ONI V \$1.00 Postpard, Complete with supposed test leads rithe Circuital (Pay Pend

HANLAN GO.

14106 W. Jefferson St., Les Argeles, Cul.





Order EMPIRE LEVELS from your local dealer.
Write direct for literature.

TOTS. 6th St. Hillwauken 4, Wis.





This is how the form-size SEAMAN ROTARY TILLER octually "crop-conditions" year seedbad for more profitable ylaids:

. . . Intractes nitrogen through sail geration.

. . Conserves and helds maisture by complete and uniform pulverisotion of soil.

... Provides more gvallable plant food by milling sever crops and fertilizer into the GROWING AREA of seedbed.

. . . Helps to destroy weeds and most crop pests.

... Helps to reduce sell gressen. ... Prometes usriser and more complete germination of seed by maintaining higher temperatures in seedbad.

. . . Enables you to get on fand seener and get crops in white weather is right.

Let us tell you about the many new Improvements in the construction and operation of SEAMAN TILLERS. There is a size to fit your form and your tractor . . . 36-inch to 72-inch, pewer-toke-off and motorized models, SEE YOUR LOCAL IM-PLEMENT DIALER and write for literature today! DEALERS: Write us an your business letterhood if interested in handling SEAMAN TILLERS.

SEAMAN MOTORS, Inc. 2.

211 NO. 25TH STREET, MILWAUKEE 3, WISCONSIN

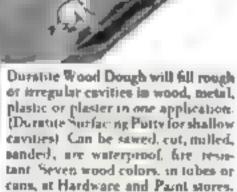


STAY IN! FKLS HOLES IN GNEY APPLICATION:



PARIS HIGH PROJECT

CHACLS AND



Made by Manufacturers of famous

WIATHIRENOOF WA ESPADICE

WERB PRODUCTS CO.

Arrowhead Cement

oc Wabb Company - Pept & - Noigibse, Georgia,



WOOD DOUGH AND SURFACING PUTT

OTHER LIKE Self-Properted BUZZ MASTER REPLACES MANY MEN

The land-clearing saw you've waited for. Eliminates the hard work of clearing land of brush, saplings and larger trees. Propels itself anywhere a woman or boy can operate. Powerful 6-KP dependable motor use for belt work when not sawing. Year 'round thathine. Most popular wood saw we have ever built. E.E.Jackson. made \$1000 in 30 days. Pats. Pending on exclusive OTTAWA features. Low factory-to-user price. Pully guaranteed.

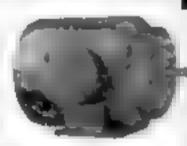
OTTAWA MFG. CO., 201 Weinst St., Ottawa, Kansas



D. C. MOTORS

Dood deliveries on &, %, and % bp Motors. Available at special DC Voltages Manufacturers of AC Ocherators Hotary Convert-ers, Lighting Plants, Frequency Changers and high Proquency Generators.

KATO ENGINEEWING COMPANY 1491 First Ave., Mankata, Minn,



Easy To Turn Trees Into Money Makes Luc Mayon, and grates, both,

SELSAW MODELS

IN 14 to 24 foct have
IN region Mechanical Field,
He region Mechanical Field,
He rost power Thiological model for comtown rost to a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | How To Make
Limber He is a few for FREE bookies | Ho

Plastics Suppli

Everything in plastics—Lucite, Plexiglas, Dyes, Rods, Sheets. Lowest prices. Send 3c stamp with name, address and this ad for catalog PLASTICS MFG. A SUPPLY CORP.

Dept. 8-2 4707 Euclid Ave. Cleveland, Oble

Amazing wer surplus radio perts hards in with new Colle Condensers Transforms on, Resistors Controls others \$15 to \$25 value Ideal for experimenters and brute home shop from Now on y 61 fix MARKO AUPPLY, Dept. PS-2s. 2024 Lagin, Bird., Chicago 47, III.

CROSMAN



America a favorite compressed air rifles for indoor or outdoor shooting are back again Avalable in 22 Cal Single Shot and Magazine Loading types At your dealer—or order direct Ask for Crosman SUPER-PELLS too—the better ammunition for all compressed air rifles, available in .177 cal, and .22 cal.

CROSMAN ARMS CO., INC. ROCHESTER 7, N. Y.



MIDGET AND WELBER CO., Strador Ave., Book, T-205, Cincinnati 28,



LIVE STEAMERS

Blue Prints and Castings in \$6" Scale for Six Engines Tom Thumb - Pacific 4-6-2 - Atlantic 4-4-2 Tanker 4-6-5-T - New York Central Hudson 4-6-4 - Union Pacific Articulated 4-6-6-4 Write for Price List

YANKEE SHOP, Machinists 88 High Street, Danvers, Mass.

HULL AUTOMOBILE COMPASS



A travel companion that shows directions anywhere, any time. Write for Circular. At your deal-

er's. Price \$3.95.

HULL MFG. CO., P. D. Box 246-E2, Warren, Chie

Army surplus at 1/10 original cost. Very sensitive. Bull on bearing aid principle, shuts out outside noise. No. 17A420 Every One Brand New, Plus 25c each for Pastage \$2.95 BURSTEIN-APPLEBEE 1012 McGee, Kames City 6, Me.

For Cabinet Finishing use PLASTIC WOOD



in your HOME WORKSHOP!

If you'd like a satiny smooth, professional finish on your next cabinet job-use Plastic Wood! It's an ideal filler for cracks or rough grains, dries tight and hard, sands to a swell finish and takes paint, lacquer or varnish perfectly. Here's an extra hint-knot holes or gouges just disappear when this handlest filler is used! Handles like putty—hardens into wood!

. . . dozens of other uses

FOR FILLING . . .

Countersunk screws

Nail and screw holes

- Chipped furniture
- PRINTED TO A COLUMN
- Loose casters
- Broken balusters Broken furniture
- You'll want Plastic Wood SOLVENT. too. Get both at one time. It is made especially to control the consistency of Plastic Wood . . . useful also in removing dried Plastic Wood from tools and fingers.

T. M. Reg. U.S. Pat. Off.

At all Hardware, Paint and 10c Stores





"For 35 years it has been my aboum to build a fine, light our. Hore it is-smoot, feet, economical."

PRESIDENT, GROWLEY MOTORS, D.C.

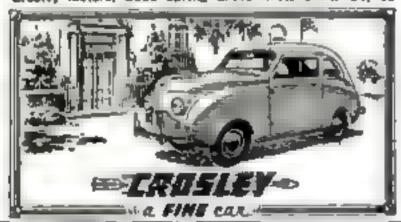
WEIGHING about 1/3 as much and operating for LEY reverses the trend towards heavier, more camberiozie and expensive automobiles!

Created by America's leading light car exponent, today's modernly streamlined line CROSLEY comfortably accommodates 4 big husbies like its 6' 4" cars, it's a big automobile—in all but weight and

Revolutionary new 4-cylinder, valve-in-bead, CROSLEY (OBRA COpper BRAred) engine in the must ta ked-nt technical improvement in internal combination engines in 40 years—gives 35-50 miles per gallon of ordinary gasoline, speeds to 60-pias, Steel engine weight but 59 lbs., yet delivers 26.5 H P See drive—this new, fine CROSLEY before buying any car'

CHECK THESE PEATURES. ALL STEFL Construction tow center of gravity, great mainty factors. M OFFICE Streams olds, the 'agreeant factor' gives extraordinary beauty. CAR WFIGHE only 1350 lbs., curbaide, perfectly balanced, weight to-power. East DR VING VINGEY Parks on a dime 'average shock absorbers. MillE HANGE VERABLE in traffic 20 inches harrower than must care a ECON. OMY that's good at the vable instant pick up, speeds to 60 p.m. a EXELIVERS for less than \$1000 to the U.S. A.

Per information and Hieratore writes Creeley Meters, 2030 Spring Green Ave., Cin'ts 14, U.



OB WORRY? LEARN ELECTROPLATING

Highly paid, uncrowded, interesting business. Part or full time. Chromium, Nickel, Gold, Silver, etc. postcard for fREE booklet and proof.

PLATER HYDE, Dept. 5 Post Office Sex 176, National City, California

How to Start

Amening Postwar Development New Gives
Tou the Opportunity to Make Money Fast!
Startling scientific discovery just now becoming available for genal use will enable you to start your own business and reap great

profits

F settles one of the most revolutionisting and rapidly expanding industries offers a great opportunity to all enterprising man and
wamen. This is one of the few industries in which home introfecturers thrive and prosper You can easi even on a spare time busis in
your own bottle, and expand rapidly into a full time business paying
and profits

Liquid MARSLE

make (1917) MARBLE the amazing Plastic, with a thousand used, Life ID MARBLE ran be poured no PLEXIBLE MOLDS for casting of kinds of artistic and serviceable articles such as ornaments, book and deal and paper weights, book and solvening, statuary, love at

Make your own PLEXIBLE MOLDS The cost is low in fact, a large that moid costs but a few conts. Sundreds of casts out be laten from a single moid

No skill or previous know edge to necessary All you do is follow our easy to moderatand instruct the

The thartest in literally unum ted You will find steady year-round demand a year own community Your problem will not be in Builing but a supplying the huge least up demand. Moreover we supply you with names of hig buyors for your finished products.

WRITE TODAY Bing Products will show you how to start with a small investment and tail & a permanent independent profitable buggass? Don't fail to group this opportunity! Write today for FREE CATALOG.

BING PRODUCTS

Dept. B15, 88 Broad Street Boaton 10, Mass.



EPAGE'S LIQUID SOLDER



them up, one man operates. Theoreands in use still heavy blade, built to hart sufery einteh control cous power take-off any tractor. Low tries, OTTAWA MFG. CO., D-201 Forcet Avenue, OTTAWA, NANSAS

START A BATTERY FACTORY



et home; the latest achievement, re-cast junk betteries into new Complete instructions. We supply everything. Big profits

THE BATTERY LABORATORIES Minneapolia 12, Mia

WRITE FOR YOUR FREE COPY OF THE NEW KRW HYDRAULIC PRESS BOOK

> Describes all manner of Production and Shop Work on KRW Hydraulic and Bench Type Arbor Presses. 32 pages illustrating the new KRW Hand-operated, Electric-operated and Air-operated Hydraulic Presses. Write for your copy today.



K. Z. WILSON, DEPT. S4, 21S MAIN ST., BUFFALO S, N. Y., 🖔

1 101.2015

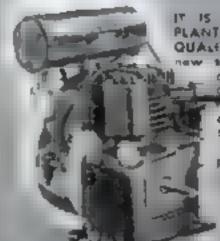
E HATESON STATE

Demand

Equipment Powered by

The CLINTON ENGINE

4-CYCLE AIR-COOLED 1 to 2 HORSEPOWER



IT IS A PROVEN POWER PLANT OF ACCEPTED FINE QUASITY The Clinton a the aw standard for perform-

once New to procepts of design of is readily monging the think no and choice of users, deglers and manufacurers employing conpact au-coaled power

A BROADER RANGE OF APPLICATIONS

Longer Illy deatures have been incorpo-TOTAL IN THE CLN.

TON to make it the preferred ling of where dependable power county. THE GLENTON GIVES YOU THESE MODERN FEATURES - a completely Dust Proof Scientillo formance ont cuty beenting costs

In addition CLINTON offers many other models with features for special adapte-

CLINTON MACHINE CO.

CLINTON, MICHIGAN



FOR JOINTING & CUTTING MOULEINGS

With our ele tach tool steel cutters With our six fach tool steel cutters make mountings ranning drap eaf tables growes besting and jointing Moulding cutters A) in wide \$1.5). Ity in \$2.00 Jointing cutters B in \$5.0 lep in \$3.00 E is in fac drap eaf tables \$1.50 E is a Makes \$4. in cove A Quarter \$1.70 Prorpaid Sustanteed State also hale hale \$1.50 e is Amnstrate Will 19. Clearwater Fig.

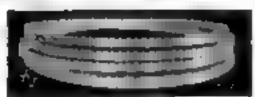


Electrically Wolded Endless

Paramount

BAND SAW BLADES

ď



Made is widths from 1/8" to 1-2/4"

Make your band saw do more work for you. The proper or this of orgins with an edge he some of this important but ching. Exemple to be systematical are made from touch bittle that will be properly and the amount of some constally make tened. Some operation between the area of the made as promptly as conditions or make the made as promptly as conditions or make the area of the conditions o

obtato hese saws a the following prices 14" 3 16" 1," 2," # 10 5'6" long ,
14" 3 16" 4" 2," W H. 6 ." forc
14"-3/16" 1" 2," Fire 7'4" Hong all each 9.5 gain 1 10 each

Or me mater at proportional prices

ALSO METAL CUTTING BAND SAWS Made is widths from 1/8" to 3/4"

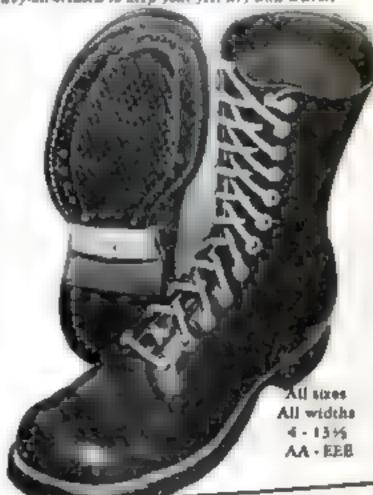
Year autistaction is guaranteed

BURRILL SAW & TOOL WORKS

405 E. Main St., Ilion, N.Y.

RE THEY ARE HE ORIGINAL Yunting Boots

Here are the ideal boots for all kinds of outdoor wear. Same design, construction and quality as famous Paratrooper Boots. Soft, rugged, unusually comfortable and beaut-ail-treated to keep your feet dry and u arm.



No other boot gives you all these EXCEPTIONAL FEATURES

- Made of soft, plothic leather with cases bedry tal wante
- to ach beight gives primer summit
- Stem of a mercure of the state of the state of the Shank it.
- Means to the and tape on sides of timep preventanteich.
- Please or often and tape on sides of nines present attention.

 In a and a sea of production to the side to present at the side of the side to present at the side of the side to present at the side of t and reduces harred to comprise

Af this Amozing Low Price 7

These beets are not gover of this consecut low pr

ONLY Postoge Postage only is C.O.D.

CORCORAN INC., STOUGHTON, MASS.

Please tush a pair of Paratroop Hunting Boots. Check [] Money Order [] for \$9.87 is anciosed. I will pay postuge C.O.D.

Address

Size and width of Shoe

PS-2



for Controlled Skiing!

For better ski control, new skiing pleasure, choose Northlands. They're hand-crafted skis designed to make your skiing surer-safer.

LOOK FOR THE DEERHEAD TRADEMARK

Send 15c for the Northland Ski Manual, a guidebook to better skiing edited by Honnes Schneider. Or write for free booklet. Offer does not apply in Conada.

NORTHLAND SKI MFG. COMPANY

94 Marriam Park

St. Paul 4, Minnesola

WORLD'S LARGEST SKI MANUFACTURERS

THOR "B" ENGIN



The new THOR B -Sensat onal Monature gasoline engine that reelly works. Super power performance Smooth vel veted power that roars into action with a twist of the wrist. Over 15 000 all ready sold, 1 6 H P Complete with cott and condenser Ready to run, only \$9.95 in KIT form fully machined. 5 minutes to assemble 36.85 without coll and condenser Powers at models Fully I) us-trated instructions. Send \$1.00—shipped collect same day C.O.D. or send full price plus 25c extra and we ship percel post nsured

FREE. Send for 32-page illustrated bobby catalog AMERICA'S BOOST COUTER, INC. Dept. 6-27 150 W 22-4 St. U. T. 11, U. T.

> When Writing Advertisers Please Mention Popular Science Monthly



Redio Sets, Communications Receivers, Amplifiers, Record Playersand Portables, Record Changers, complete Sound Systems Press and pages of top-quality standard-make rudio and electronic parts plus scores of special value bardains Thousands of Items NOW IN STOCK and ready for IMMEDIATE SHIPMENT! Write TODAY for your FREE COPY. Piense address Dept. P5-27

CHICAGO 7 901 W. Jackson Hivel. 265 Peachtree Street

262 SCIENCE

Portable Paint Sprayers



Complete as Businsted, less motor. Outfit consists of compressor, garage que with ut cup in it hase. Y's best and drive pulley for major, Immediate de very Check or M.O. with order

SPEAT GUNS WITH PT. CUP-4.85

21' AIR HOSE-3.00

INDIANA APPLIANCE CO.

36 East Sycamore

Dept. PB-M

Evansville 8, Ind.



STUTY AT HOME for PERSONAL SUCCESS and LARGER FARS No. 8 38 years capert matruction over 108 (68) students encolled LI B Degree awarded A literia furnished Easy payments. Sond for FREE BOOK Law and Executive Guidance's

AMERICAN EXTENSION SCHOOL OF LAW Dout, 74-5, 644 N. Michigan Ave. Chicago \$2,111,

SSS if trained in

Big income jobs doubt you. Least quickly and throughly forest under G. J. Boll With rades Highert Trade School, Inc., Sex F-Mil Tray O.



Mane Radolet pour buring headquarters for the its fits croate tops of any replacement based large stucks saute fitted most complete or those of all available tions at owest purch the large arters over we special attent of feature the large Bond today for FREE Radolek Switte Street

RADDLES CO., Bast.A-121, 881 W. Baadelph St., Chicago B.



ELECTRIFY your

Battery Operated SELF-CONTAINED • SELF-PROPELLED

We show you how to convert your own lawnmomer for use with a car batters. Bare energe lates and time with this self propelled unit. Our simplified plant make it esty

LEJAY MFG. CO.

228 Lajay Bidg.



Camplete Plans \$ 100 Minnespolis 4, Miss.

BE A MANUFACTURER'S AGENT

This Booklet INCREASE YOUR INCOME!

Lagra a business in which profits are limited only by your energy and alatity—no beary prachesis could Virtu today for this valuable book, bears the fung-Many of an agent, how to contact manufacturary, select products and where to get least unlines available. \$2.00 postpold. 530 J Andres Side.

VIMAR CO.

Mpls, 2, Minn,



Here a your chance to start a fine, solid, profitable business right among your friends and neighbors. The up with the LEADER, in the direct-to-wearer show industry established to years Just rush postered NOW for PRES SAMPLE OUTFIT Free 19 Second Air Cashion Demonstrator Pres Automatic Selling Flor Learn burn you can start that he manage very FIRST DAY with mean 200 fact neiling Feature Style and Comfort Shoes

CO Dept V-788 619 W. Van Bures St., Chicago 7, Ill.



"EMLARGING IS THRILLING"

fully corrected, quality anas-

tional lens is included in the

modest price of every Federal.

Starts at the beginning and takes you stop by step through the advantury of enlarging. 48 amusing, illustrated pages.

25c at Comora Stores or Send Coin.



≠FEDERAL MANUFACTURING & ENGINEERING CORP. Makers of Pholographic & Electrome Devices 213 STEURIN STREET - BROOKLYN S, M. Y.



ASSEMBLE KING MIDGET

Fractical bighway racer canabout, we supply at parts Just but to-gether. Law cost. Ready for de twery Milw One or two cytibles 40 m p.h. up in 100 h see per Fatton Send 35c for complete I tersture with large picture 3 view drawings price of parts or send 31 for the above plue 4 actual photogramic plane for apow and her conversion estangua of new and used motors matericanters transmissions clutches other offerings etc.

MIDGET MOTORS, Athens 2, Ohio

TOOLS—PLASTICS—SUPPLIES—ETC.

New Decorative Plants Famile for table tope etc Also aluminates for m. Plants in Plants Screws Coment firsts Tabe Otes, M. ting Cutters Torches, Flux Bran ng Wire Screws Assertions Shaft ng Bearings, Put'eys Mandrels Machine Ramiles, Fexible Shaft Tools, Electric Drift sele Many other Frag. 70% is atock New Studiests of Catalog D-15c, Maripine Supply Co., 1420 Seets 16th Avenue, Maywood, Hillorie,



Sinte for 6" to 16" motel lather BUILD IT YOURSELP from our sets of cemi-machined castings and save \$6. Can be finished on your lathe sinne. Complete working drawings and stepby-step machining instructions

furnished with castings

Mill keyways, slots, spinnes, dove-tails, flutes in reamers saps, hobs, and special cutters produce spur bevel, mitre and worm guars, ratchets and racks, mill flat surfaces, square shalts. Mill heres, spot face, drill spaced heles, bore, etc., on your lathe with

this precision attachment. It has a T-slotted table, a vice which awivels for angular milling a grar cutting fixture and dividing centers

FREE Mostrated In der and price list Mention your athe Write today **HUNON MACHINE AND TOOL CO.** TALE 2. MICHIGAN



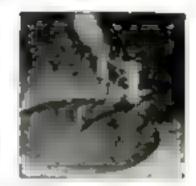
Smooth, steady power at your fingertips! Perform precision operations not possible with any other portable tool! With a Handes you can turn out professtonal looking projects for pleasure or profit—ship. plane and train models, costume jewelry, wood caryings, puppets, initialed tumblers, etc. AC or DC. 25 000 r.p.m. Wt. 12 cs.

use the Reset Accessorest Choose them from the most complete line , . more than 500 made right in the Handee plant.



MEW PRECISION ATTACKMENTS

Fit Handes only, enable novice or craftsman to do perfect work. Magically, easily, your offband carving, routing, shaping will be exact as to depth of cut, accuracy of line. Bet of @ attachments with instructions, postpaid



b s

BC-

ORDER NOW! SATISFACTION QUARANTEED

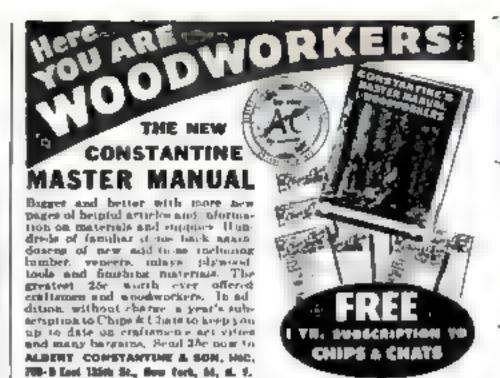
FREE! NEW 52-PAGE MANUAL

CHICAGO	WHEEL	LAN	RFQ.	CO.		
LLOL W. Me	mree St.	Dogst.	PQ. (Chicago	7.	141.

CHICAGO WHEEL & MFQ. CO. 1101 W. Monroe St. Dopt. PQ, Chicago 7, III.						
	G Headee					
Name.						,
-						







New! 12"Sheet Metal Brake Only \$10

Fits in beach vise Quachty county farms at a hole of anjure in shret meta , strain to be and guardie the strain of the reader articles, we could plantic the life to reader marks and articles, experimental respects which parent marks and articles, experimental respects which parent marks articles a respect made for data a security straint was available. Need for data a security straint was available. Need for data a security straint was available. Need for data as articles. The traint to be \$2.00 to \$12.00 p.p. Wt 10 like the first the straint of the first the straint of the straint of

VISE BRAKE MFQ. CO., Bopt. P. S. 1318 So. 38th Ave., Omeha 5, Netr,

PLASTICS Special Offering- 65c Per Lb.

Plexigles Sheet Stock, Reduced from \$1,55 per lb. 3/16 thick sizes: 12x24 & over M namum order 5 be Order in units of 2'; Lbw 100 Lb lote- 60c per ub Orders under 25 Lbs 10' handling Chy Over 2' Lbs 51.00 Min hand. Chy Also complete line of shrets rods tubes, dyes coments 4 all plastic supplies Send 10c for literature 4 Pabricating

MOUSE OF PLASTICS, 7604 FEMKELL, DETROIT 21, MICH.

LEARN TRIG QUICKLY—EASILY



WITH OTHER TRIG. by compett, we took the faster to one with a slight whom edge of this than to an ellect in ledge, he all is rule test the object of the professor of the profes

REED MFG. CO., 124-P W 4th St., Los Angeles 13, Colif.





MYSTERY THIRSTY BIRD

Here's the nearest thing to perpetual motion to date. The bird just dranks and drinks and dranks.

No machinery. Nothing to wind,

Words can't describe the amazed faces of those who see the mystery thirsty bird in action.

SO, SEND FOR SOME IMMEDIATELY, AND SEE FOR YOURSELF HOW THE DARN THING WORKS.

Incidentally, our thirsty bird makes an original and welcome gift.

Only \$2.50 postpaid. Sorry, no C.O.D.'s.

MAIL THIS COUPON NOW

Gentlemen: Please send me at once, postpoid, Mystery Thirsty Birds. (quantity) Enclosed find \$
in _ check _ money order
NAME
ADDRESS
CITY and STATE
Money Back Guarantee

BOWMAN PRODUCTS

8th and Butler, Philadelphia 40, Pa.

PLASTICS

Patricating platfics offort you a fatchating hooty or a profitable but note. Now Carmen-Branson Platfics transbook tells you how; gives construction plant. New

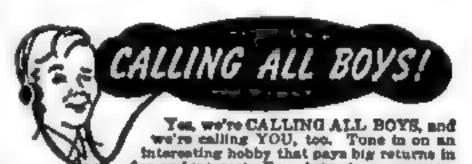
Construction plans. New Construction plans. New Bakelile, Lignolite. Testte it Lumerith in aborts rods tabes special shapes—clear and glowing calers. Also plantics dyes, tements, accordance and appearance. Too brings you both estains and hondbook. Send for those today.

CARMEN-BRONSON COMPANY

165 East 3rd Street, Dept. 2-A

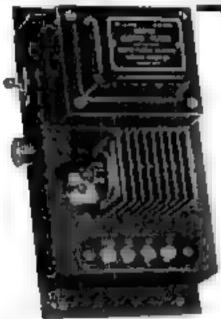
Mount Vernen, N. Y.





for a curver in radio. Learn how to make your own simple, tobeloon, batteryless crystal radio. Just send the, We will send you postpaid by return mail a genuine Malomite crystal with complete illustrated instructions for making your very own set. Then you will enjoy competing with others for long-distant reception. With crystal and instructions we send The Magic Crystal, our own publication check-full of news, diagrams, questions and answers of interest, Don't delay! Send the today!

ALLEN RADIO, Dept. PSM-2, Clinton, Missourt



COMPLETE ELECTRO PLATING OUTFIT

PLATE WITH GOLD, SILVER, NICKEL, COPPER, CADMIUM, ETC.

 No experience needed. Simple instructions enable you to start plating immediately

 Originally designed for jewelers, this unit is now available for home craftamen. Thousands in daily practical use in jewelry shops.

 Can also be used in place of batteries where low voltage direct current is required.

For 115 volts, 50-60 cycle A.C. only. Output 4 amps —8 volts D.C.

LOCDES IN HYDRES

HOOVER & STRONG, INC.

115 W. TUPPER ST.

BUFFALO 1, N. Y.

Price of complete outfit, including Plater, 1 quartiesch of Gold Copper Stripping Clouning solutions 3 Anodes and Pull Directions f. o. b. \$19.50

Send Money Order . . , we will ship express collect . . . no C 0 D e



SCHULT OFFERS FULL VALUE IN A FURNISHED HOME

The Schult Luxury Lines. built to quality standards by ploneers of the trailer enach Industry office you an unbentable combination of living comfort and value, available eight upic!

In one parkage you get well heated well maniated mobile howeing, ingressor-ly designed fuentture, a kitches equipped with refrigerator, oven range and double unk.

EVERY PACILITY OF A 3-800M HOME

The Luxury Liner contains three reparate course . alcepa four comfortably . provides all the wardrobe, closes, and drawer space you need luxuroundy formulied and decorated, metades vanity with built in lay atory or totlet room.

See a Schult! Write today for dealer's name; we'll send latest catalog, too,





SCHULT Trailer Coaches

CHICKS 730 Days Trial

grammates, Money refunded on one this but true to bessed. No need to take things I've get 20 days to make care which a mi represented Main or pullet chicks ujebud. Low prices. All varieties. Me sien, Rig discounts on early erders hits Me MESOURI STATE NAVEMENT, Box 200

ALUE MANIEV A., ALAAN INE

SWINGS

FITS ALL CARS mileage with a Vacu-matic on your car. Quicker pick-up, smoother running, added power saves money every day. Guaranteed. Automatic Supercharge Principle



B g profits. Every Car a Prospect. Send name and address for FREE PARTICULARS and how you get yours for introducing

Yaca-matic Co., 7617-1302 W. State St., Wacavatesa 13, Wis.

THE UNIVERSAL LIQUID CEMENT

The "Mr. Fix-it" for "a million things"

Tops in quality for 37 years. Uses unlimited . . . sticks and mends permanently. Waterproof . . . quick drying. Keep a tube on hand always, Extra quality ... extra strength. Ready to use. LOOK! Get acquainted with Ambroid quality. At your dealers or send 25c for big 2-oz. tube postpaid (U.S.A. 75¢ only). Money back guarantee.

Ains 30x 4-st. Inbu. Pts., pts., gair, for saderfriel etc.

AMBROID CO.

367 Franklin St., Boolea 18, Mass.

AUTOMATIC RETOOTHER

Mokes New Profits

Cuts new teeth in 50 secondal Any size tooth 4 to 16 points Old teeth fail off as chips. Simple to operate. A perfect job.



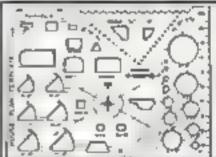
Immediate Delivery

BURR MFG. COMPANY 8931-A Venice Bivd. GOLD TEETH WANTED

Dental gold teeth, plates and bridges with motal attached Any broken pieres of gold Jews ry Immediate payment and free making container to you or your friends upon request LOWES Holland Bidg., St. Louis 1, Me. LOWER



with the for mach more flags COMMERCIAL THADES (NETSTUTE 1400 W Greenical Ave. (Oupt, X(2)), Chicago 24 III. VETERANS ASK FOR GI PLAN



HOUSE PLAN TEMPLATE

Made of elear sheet pleatic, with accurate out outs for drawing door swings, glumbing and elec-tric fixtures. Brenines, stairs, me dings, cool pitch, etc. Stand-ard % at 1-0 stails.

SI SD POSTPAID Send card for list of templates TIMELY PRODUCTS CO. Bez 206E, Celumbus 9, Ohio

LETTERHEAD

Printed with your own copy on 16-lb. Bond. Sorry no CO.D Send 25c for our catalog listing 1001 Printing & Office Supply Bargains, 25e refunded on your first order

A. F. LIGOTTI, Dept. PS

569 5th Avenue

New York 17, N. Y.



SPECIAL HUNTER'S

Hunting Case, Wotch Type, All Metal, Jeweled Waltham

SPORTSMEN'S RUBBER GOGGLES

White Piastic Lens and Extra green Palarting Lens Plastic Lens are shatterproof Polarising Lens a protection against reflected glare, encessive light dust and wind ideal for industrial use Motoring shi ng and all kinds of cuidooy use. Value \$3.50.

SPECIAL \$1.50

Engineers All Metal Army Type Hand-Sighting

PRICISION QUALITY



Whestatone Bridges used, in eacel out coudt thun. Made by Thompson Lever Mrg. Co., Philis

Value \$150, , , , . Special

PUBLIC SPORT SHOPS

13 S. 16th St., Phile. 2, Pe.

No COD's

NU-WAY **LAWN MOWER**

Write for FREE Circular

Price 12.50 Why Pay Mura

Build Your Own

Rotory Type Lawn Mower

We Supply Cutting Unit Complete.

> NO INCREASE IN PRICE

TRACTOR-LITE MFG. CO., SPIRIT LAKE, IOWA

ITS EASY PICKING

from a Huot DRILL INDEX

A bandy container for indexing and filing twist drills. All steel-ten sizes, Cor-SEND \$1. for No. 12-holds drills from 1/16" to 1/4" by 84s, (Or see dealer.) Order Today.

HUOT MFG. CO.

436 FOOT, SCHULTZ \$LPG.,

ST. PAUL 1, MINN.





route, actions, occasi, grooten No extra blades to buy Over fifty thousand now in use by hobbywts, pattern and cabinet workers, etc. Satisfartion guaranteed or your money back. Complete

ALL-METAL DRILL PRESS TABLE

Solid Aleca aluminum heavily ribbed. Blanch-ard ground top and bottom. Equip-ped with Barton adjustable steel fence. Extra large working surface 13" v 16" Fits all standard drill presson. Instantly mounted or removed

SPIRAL FLUTE ROUTER BITS

New 45° below angle tool steel design for amouther, faster, accurate couting, gronving, carving mortning. Extra long cutting flutes. Indivi unl muse 36" to 36". Prices on application. Complete set of els graduated since.



ROTARY SURFACE SANDER



First chuck of any drift press. Provides antismooth, even, accurate surfacing of eroda, plastics and metals. No religin, no strictions. Original in design, a great labor saver Complete with 20 sanding disco. fully guaranteed.

Liberal 10 Day Massy Back Guarantus

Workshop Guide fREE

BARRON TOOL CO.

470 Architocts Bldg., Datroit 1, Mich.

ATTENTION HOMECRAFTSMEN

PLANS for Dutch Windmills, Lighthouses, Bird Houses, fine furniture, also a great variety of Lawn Figure patterns, strong target patterns, and the furniture patterns, and the furniture of Lawn Figure patterns, are a great variety of Lawn Figure patterns, and the furniture of Lawn Figure patterns, and the furniture of the furnit Craftsmon's Model Co., 2036 N. 41st St., Dept. K14, Milwanken, Wis,



Maturius, Tools for HOME CRAFTSMEN AND MECHANICS

IF you work in metals, woods, plastics or glass, you need this Big, FREE Source Book of equipment, tools, parts and materials . . , including dozens of hard-to-get items you can't find in stores. Many things you must have for your home hobby or shop. Just loaded with ideas and illustrations.

A WAREHOUSE OF THINGS YOU WANT

More than 100 Items including: Portable Welder; Bench Tools: Plastic Molder, Telephone System, Chemical Sets. Spray Guns; Electroplater Drills, Gunders, Tool Chests, Model Tools, Key Maker . . . everything you need for your hooly or craft. Send too this Big, FREE Book TODAY. Mail postcard or coapon below.

Warming ELECTRIC CO., 1512 Jarvis, Chicago 26, Dept. 1,-113

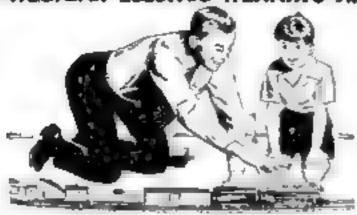
		1512 Jarvis, Ch		
PLEASE SE	ND BIG, F	REE BOOK		
NAME			***	
ADDRESS.		4 - +		

.ZONE

STATE

CITY

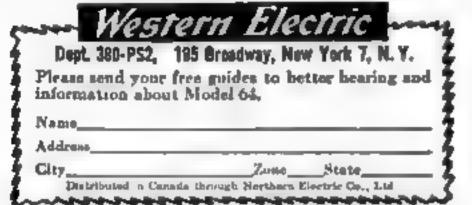
DAD'S LOTS MORE FUN SINCE HE GOT THAT WESTERN ELECTRIC HEARING AID!



There is a difference in Hearing Aids

 Western Electric Hearing Aids are made by the nation's largest producer of communications and electronic equipment. They are the only hearing aids dengued by the famous Bell Telephone Laboratories.

So, Western Electric is a name you can trust . . . for better hearing. Your hearing aid is a companion you'll rely on for a long time; it had better be the best, Ask about the new Model 64 Hearing Aid.



ELECTRO MAGNETIC

An important labor-sever every re-pairman will use in many handy ways. For momentary work Plug in any AC socket 110 volt 60 cycles size 4% dam by 3", with 22" cord and plug attached Complete with instructions. Ship. Wt 5% lbs. No. 7818-09 y





FULFLO HEAVY DUTY FILTERS

Famous Fulfio Filter is ideal for gas, alr or oil Stands 250 lbs. pressure. Has a luiet and outlet LP T, Heavy bracket attached for mounting. Compete ready to install Overall age 3 9/11" Barn. 5" high Ship. \$ 1.95 Wt. 4% lbs. No. 4753—only Lots of Tee \$1.85

SANDING CLOTH 3-M-I. T. E.



The perfect abrancy of Extra tough grained Gris 150 x 04 0 12° diam 3° bole Gris 150 12" diam 12" filam 3' hole
Use to disc ar cut up
at othery rioth. Made
by Monesota Moing
and Mig to Ship
Wt. 2 he While supply anta No 27008
25 discs \$ 1.28
for only

FREE CATALOG

.

.

•

۰

æ

Ġ.

New! Laste hand of ert. Floring in the die purts. Why come only. Write Today!



Send thick or menny order including postupa

Dept. PS-14 400 N. SANGAMON ST., CHICAGO

Send and Receive Code with this PROFESSIONAL Same or used by U.S. Signor Corps Learn code quick a and have loads of fun with your privote" intercom system. No distance mill between stations. Send \$2.00 with order, pay balance to postmon. Satisfaction Guaranteed!



"A thing of becuty Is a joy forever-"

Specialists in worthwidle SCALE SHIP MODEL KITS AND FITTINGS

BOOKL SHIPBOYS 476 Main St., FORT LEE, N. J.

Meter Arber and Combination V Publey to" eight .. Bbc-to" left... The No & No right and left



to At

\$3,46



Add 10% for Postage U S A Send 3c Stemp for Circular 584 Communicate Ave., Jarsey City 4, N.J.

When Writing Advertisers Please Mention Popular Science Monthly

110 VOLT 60 CYCLE SRAMD NEW COMPLETS UNITS COST NAV





American on set You get two aspects on it. W. I as two A motors we as an At generator P a with be t bourtogs, put shed aluminute A me appearable granders form no thing heads, etc. can upo at a large time to the a property of AC of a contract of a contract to the appearable of AC of a contract of the appearable of the contract of the contrac ean maps to these essent with a serule AS view is in uperate as a formation of the ruling to the A so SINC 2 110 h had son general

ag . moter entuble for A so \$100 from etc. or mounting property of the street of the control of the street of currency or wil arno C.O.D.

:EXHAUST:BLOWER.

NEW! IMPROVED FOR MANY USES



Darkreen exhaust fant

X-ray and storile rooms Photographic beeths, commercial, etc.

Motor Consignmen quiet fam 1585 bearing 110 volt A C 50-60 cycle Capacity 100 cu ft per minute Motor casing black crackle finish aluminum municipal

WEIGHT !!

Ends heavy cost

Built for Long Life Tropble Free Performance Send Check or Money Order No C O.D. s. West of Massissipal-Add 51 00 for mailing and handling.

IMMEDIATE DELIVERY

BNIYERSAL TONKERS CORP., 41-3 Lucust St., Youkors 2, M. Y.

•

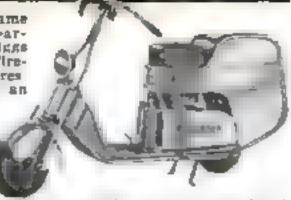
•

.

۰

Welded tubular frame and body: Timker bearings; Lawson or Briggs engines optional. Firestone or Goodyear tires Speeds to 40 miles an hour up to so miles per galion.

You will find years of reliable serv ice in the New 1847 Lightweight



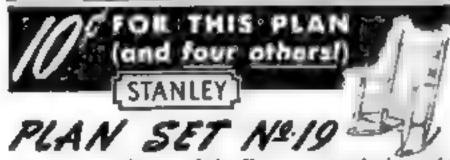
Bre your dealer-if no dealer available, write or wire direct.

AMERICAN MOTO-SCOOT CO. Dopt, 2PS 1305-23 W. Correll Ave.

SIMPLIFY YOUR WORK WITH TRIG-EASY CHARTS FOR PLANE, SPHERICAL & COMPOUND ANGLEST

EASY, quick way solves all angle problems. You calculate machine set-ups, layouts or designs with accuracy. A knowledge of higher math not necessary. A set of three pocket size charts & 144 page. book of litustrated netructive problems stiff only \$2.00 pestoard Descriptive circular FREE on request. Start learning poster ways to do your job. Order these charts now, Maney back guarantee.

TRIG-EASY E. H. Needhom Dept. 4 L Culver City, Calif.



jo make, usejul objects for home or gifts. Bet No. 19 includes: Child's Rocker - Bednide Chest -Dressing Glass - Portable Towel Rack - Sewing Kit.

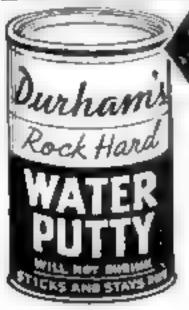
Yours, postpaid, for only 100 - send today! Or write for free list of all Stanley Plan Sets, STANLEY TOOLS, 227 Elm St., New Brittin, Connecticut.



PATTERNMAKERS MACHINISTS-TOOLMAKERS

Change Corsiner Tool Cheets for complete est-infaction. Free calaing root CHESTE

847 Columbia St. Cayson 7, Ohio



ine Mudern Plastic for lesting Home Repairs

PERMANENTLY mends cracks or holes in wood, tile, stone of plaster Sticks and steys put-Does not chip, shrink or fall out. Easy to me. Economical. Mold it, chisel it, polish or point it. If unobteinable from your lumber. paint or hardware dealer, the big 4-lb. can will be sent you postpart (in US.) for only \$1. Full money-back guarantee, order now.

DONALD DURHAM CO.

Box 304-B, Des Moines, Iowa



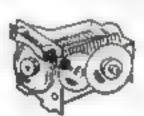
ES, here it is at last - the most complete catalog ever offered by Lafayette - world's largest radio supply house. And what a catalog it is! Pages are brimming with an amaxing display of radio parts, build-it-yourself kits, microphones, record changers-and hundreds of other items.

All the tried-and-tested standard equipment is listed—also many items so recently developed that they're shown for the first time. Everything in stock. Be among the first to get this, America's greatest radio catalog - FREE.

TYPICAL LAFAYETTE

BARGAIN

Each post Individually measured with maximum copes by murked on end plate. Average maximum copacity 120 minfel. 94-to-1 backlock-free worm drive. Order NOW No. HE 175, Your Cast Only 78¢.



RECESSION TOTAL PROPERTY.

100 SIXTH AVE. NEW YORK 3

110 FEDERAL ST. 24 CENTRAL AVE.

90510N 18 NEWARK 2 LAFAYETTE RADIO Dept. K8-7

100 Sixth Avenue, New York 13, N. Y.

Rush my free copy of your hig new catalog,

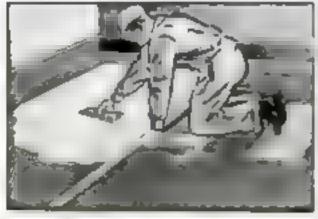


ild it Yourself

Send for booklet showing how to make your own bricks of Comadabe and build an attractive low cost home yourself. Amaz-Ing discovery in soil stabilization, Bricks of earth and coment. Attractive; heat and cold resisting. Easy to make. A Godsend to anyone who needs a home. Now being used by hundreds of satisfied home builders, Acceptable to loan agencies. Complete instructions in attractive, easy-to-understand booklet entitled "Cemadobe", 50 illustrations and 40 chapters. Money back guarantee of satisfaction. Send \$1.00 to Cem-Adobe Company, Box \$1, Dept. PS-27, West Los Angeles Station, Los Angeles 25, California.

APPLYING OR SELLING

CORKS PLASTIC FLOORING



Here's your apportunity to get into business for yourself applying or selling Corkstone, the economical, top-grade plastic flooring. Plenty of profit. Act without detay!

Dealers & Agents Wanted

WRITE FOR DETAILS

LASTING PRODUCTS COMPANY 200 SO, FRANKLINTOWN ROAD.

POPULAR 270 SCIENCE

CARBIDE SCRIBER HON-MACHETIC-

FOR MARNEST STEEL, GLASS, ETC.

Tungsten Carlade - the hardest metal made by man -carefully ground on diamond laps, brased into stainless steel 6"

handle for marking steel and other metals - for etching, murking cutting glass. Cuts all directions. Easy to follow any contour. In plastic case with pocket cl.p.



C)

Bestare, Bistributore and Salar



WRITE FOR

The Rite Way Mower Attachment & Salt Bracking

BAVE MISSET SAVE TIME

Now anyone can save time II S FOW YO BOOLD d effort mowing field or lawn by buildtog their own whirl type power mower, stalld according to your own ideas and goods at small fred. Cut close to frages, wasks buildings, etc. Build in short time with parts and instructions we furnish Save hours of time and back breaking labor. Write today for FREE information,

T & H MFQ, CO., Dept. 5-1 ™ #11 E.31, Kan, City 3, Ma.

TRAILER AXLES, HITCHES, AND PARTS

of from are interested in purchasing trailer ax es hitches and other trailer parts, contact us promptly

Write for free literature

NAMMER BLOW TOOL COMPANY, Dopt, D-10, WAUSAU, WIE,

arc welding . Teacher you have to become po no manual and text beder lader Willio teday? book ... \$200

welding operator - one of highest paid.

Hobart Bres. Co., Ben F. 67 Ohle

PLASTICS LOW Prices

Oracle ! Plentiffus no seconds no scrapa thin full threats Comme e notice long and concern to luded By baran to Rit No. 22, Fig. Kir. No. 33, 45 70-NIC No. to \$5 20 Lettinosent dies a no stallen r. Sa r tomes. Order voor kirs not Send ricek or maney order tours A-b) 10% for tentage and handling Latinton Bala Salary

JACKSON STUDIO Dept. 4, 6444 I Standard Ave. Milmakes 11 Wh.

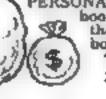


MIDGET AUTO RACING BOOK \$1.10



45 F0708, if story 1946 Cand Racing \$1.10, 1946 Indiamapolis 400 Hare Hook \$1.00, May-cedes Benz book \$7.00, New purind (As on) Clarated Section (almog free CLYMER Dept. \$2, 2:25 W Pico, Les Angeles II, Cultf.

BE YOUR OWN BOSS! INCREASE YOUR PERSONALITY" and 'FACE VALUE 'our latest "PRICELESS books can show you the way as it has for thousands Cloth bound \$2 each Paper bound, \$1 each. AGENTS WANTED! THE MARSHALL ADRIAN CO. 367 Colorado Bidg., Denver 2, Cole.





THE WAR'S TOP SECRETS BRAND (NEW) ARMY MINE DETECTORSI

Portable: Will Detect METALLIC and NON-METALLIC objects, Very Sensitive: using 155 Tube in detecting bead, two tube ampuher using two thigh, beadest, or microphone; also 150 micro meter. Power supply 2-46v; one 6-v, or 2 3-v. batteries. Complets with lastr Less Balterim: packed in original cases, shog. wgt. 108 Lbs.

JOB. From N. Y. Special

Sand order to

COLUMBO TRADING CO., INC.

304 CANAL ST. NEW YORK 13, N. Y.



I am no patent attorney but with my 25 years of experience with inventions and patents I can help you dig out that deep-seated secret of an invention that tests its commercial value and gives you understanding of the proper thing to do with your invention. I also furnish you with the most ente and reliable method for securing patent and market. Full information sent to you free on request.

II. C. GARNES

F. O. Box 85

Attica, Indiana



STUDY AT HOME for PERSONAL SUCCESS und LANGER EARNINGS 36 years expert instruction - over 104 00m audents enrolled LL 8 fex es awarded Al' tests furnished Kans paymen . fund Law and Engentlys Quidance's for PREE BOOK

AMERICAN EXTENSION SCHOOL OF LAW Bupt, 74-5, 646 N. Michigan Ave. Chicago Lt. (il.



ŧ

6-H. P. EASY TO MOVE

FELLS TREES, BIG LOGS, SMALL LOGS, LIMBS

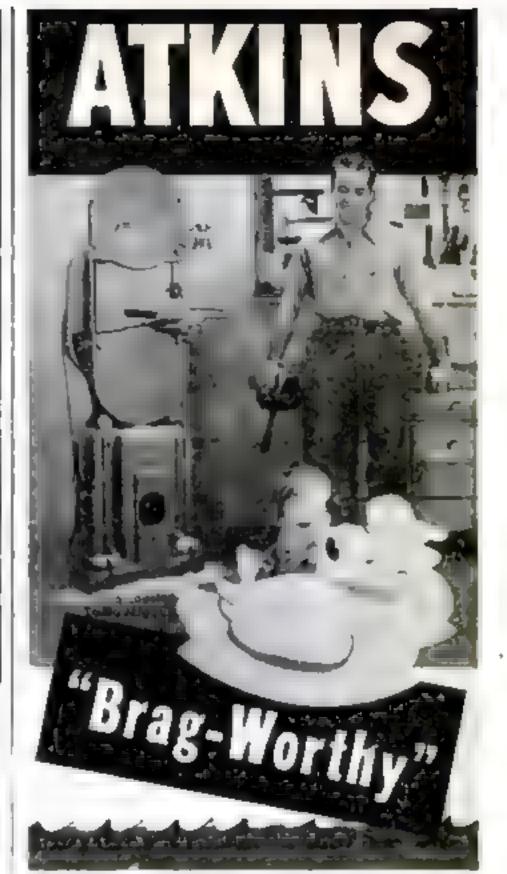
One motor performs all three operations. Furnished with or without attachments shown below. Thousands in use, Make BIG profits in the



ever incressing wood basiness. Pulley for belt work, Fully guaran-teed. Low direct-touser prices. FREE details-write TODAY.

WA MFG. CO., 201 Piec St., Ottawa, Kansas





You have every right to pride in your own fine handicraft. You're equally entitled to pride in ownership of fine tools that make it possible—tools of craftsman coliber like Atkins "Silver Steel" Saws.

Every sow in the Atkins line can be depended on to cut easier, cleaner, speedier . . . to hold a razor-keen edge for longer . . . to make every hour spent in your work shop count more. "Curled Chip" hand saw blades are typical. Their unique "Skip Tooth" design assures smoother cuts every time-makes the "fussiest" cutting job comparatively easy. Yes, good work-

manship is worth bragging about, and tools that make it possible are worth waiting for.

E. C. ATKINS AND COMPANY

Indianapolis 9, Indiana

 When you need pulleys for your power equipment. or home appliances be sure they are Congress Pulleys. They are made of the finest alleys under conditions that assure highest quality, perfect balance, long life and satisfaction to you, as evidenced by the fact that leading appliance manufacturers have now standardized on Congress Drives Each Congress V-belt pulley, variable speed and flexible coupling has been factory tested and individually packaged for your protection.



Sign of no Authorized Congress Dealer

At Your Local Dealer

You can get Congress Drives at all leading hardware stores, Look for the uign at the left. It shows a store that carries a complete atock of all the popular sizes. available to you at the low prices made possible by our vast production and our policy of apecializing on drives alone. For America's biggest value in pulleys go to your hardware dealer and say "Congress, please."



PRODUCTION

order benjamin air Rifles & Benjamin air Pistols from your DEALER. Send for our FREE FOLDER and Complete Specifications TODAY. Both Calibre Benjamin R-C Pel ets are

BENJAMIN AIR RIFLE CO., 811 MARION ST., 87, LOUIS 4, MO.

* * * * ATTENTION!

The B & H Footsbift for all Harley's eliminates hand genr chift given fast getaway, greater maneuverability, meximum driving nafety. Improved clutch lever booster Easy to matall. Write for details, prices SCIENTIFIC RESEARCH CO. Portland 12 Ora



Ocabilpol

MAPINES.

diet metric

سانن پ

والماران مواديا فالغنث فألجن

Good-Tax

GAS TORCH

The Modern Way of Soldering

Ideal for hard and soft soldering. Will heat quickly solder will flow freely and smoothly. No compressed air required Nothing to pump. Belf-adjusting Safe Economical Can be used for annealing small parts and bending metal parts. Generates a heat of 1700° Pahrenheit Simply connect to any lituminatand gas jet with a rubber hose and operate.

Tornado Torch No. 119 comes with three (2) tips, (16", 16", 36", 36" biast). The Tornado Cas Turch No. 119 complete with three tips to \$2.95 See your dealer or order direct. Send check or money order post paid

Robco Corporation, 204 E. 44th Street, New York 17, N. Y.



SPECIAL EASY MONEY-MAKERI

Our new free book is crammed with money making to to about Leasher Linty Wood Carring Cing Madeling Locing and Binidi's Wood Huening Heady to Finah Wooderst, Plantes, Mariette Mading and much more Send for FREE copy TOPAY!

SPECIALI EASY MONEY-MAKERI

Newest tashed idea Leather Link Botts Very amort for both then and without Kit Individing everything for any comake being (2 white 2 black) broken) hatthe to soil at \$2 oach \$12 total broken) hatthe for only \$10 00 postpaid for \$10 years in the property postuate No Canadian C () b' and no foreign alluminate made) Maney back if bot de igned Rample Kit (1 belt) \$2

BWIRNELL CAAFT SHOP, Dept SC-72, Elm Green, Wheeling, W. Yn.

Beautiful cabinet and paneing slock Perfect for many projects and

SWITCH

for general construction and cabinet work. Thekaused panels 6" x 6" through 48" x 90" 1 32 through 3 4" Birch, Gum Oak Mahogany Walnut, Maple Besswood, Send 10 cents today for complete Plywood Catalog.

CARMEN-BRONSON CORPORATION

165 East 3rd Street, Dept. 2-A, Mount Vernon, N.Y.

It's easy to build this household appliance and profitable to use. Save up to 75% Operates on 110 or 32 voits Plans show 5 sizes and are easy to follow ENJOY MAKING ONE OF three freezers from new or used parts. No ex-pert knowledge needed Mail \$1.00 bill or for complete plans and estatog. LEJAY MFG., 421 Loley Hits, Missoupels S, Miss, 8 to 40 ca. ft.

U. S. Army RADIO PHONES

Water, theth wester Prest) Made to 1. B. Army Specideatoms pussed by Signar Corps Instead
for Issuary Microph no and Dynamic
hecetver of Finest Quality Water Shock
Weather and A tude Proof used on task
and siccraft (BIS) intercom the eme. For
recording for battery less lelephone TALE
form to HIS the District ST to 1 SE FAR
phones for Dates were the form and Agent Land and dynamic hand miand dynamic hand mi-PIGIT-1 4. 142.14.

\$8.95 or ling court set A REST MAR. Postpoid WHILE THEY LAST

OHLT

V TSATILY SWITCH

M 11 NS 15 POST WAR

AT LICATIONS Flood

Hight your sorth when the
shoet is opened bounds

alarm when window is obened . Signals arrival of shall

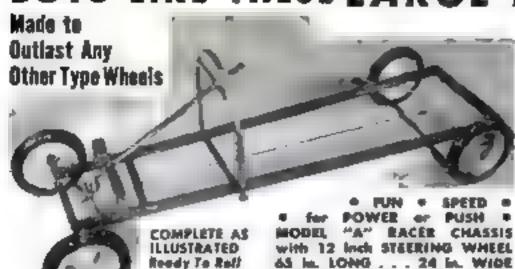
truly healing of furnity Filling of

three and many ather services are perlarmed by this VERBATILE SWITCH. So speed with inel de 6-th a seri a smaller superrous fidustrated uses. At the first owner a nowing by the transfer

\$1.00 Postucia GET YOURS HOW KING PRODUCTS CO., Dapt. PS-4, BATAVIA, ILL.



BOYS LIKE THESE LARGE 10" x 1.75 WHEELS



65 In. LONG . . . 24 In. WIDE Weight Apprex. 55 Pounds

Pob. Doplestown. Add 15% for Proposid Shipment in U. S. A.

BUILD YOUR OWN RACER •

With Genuine GATES Style 508 and GOODYEAR Style IS DEEP TREAD PLNCTURE PROOF SEMI-

Note: these ARR NOT the top street used by most wheal manafecturers.

MEW: V BELT PULLEY DRIVE A BRAKE DRUM
One Combination Drive and 10' x 1 75
Wheel Asset bird PRICE 5.30
One tomb nation Drive Wheel and Chree
we thous not of 4 PRICE 513.00
Same as above with 2 20' x 1y' axion.
4 hangers washers a cotter pins.
4 hangers washers a cotter pins.
5 same so above with 24' long x 5 s' dia
as a 4 hangers, washers a cutter pins
BEAD FOR USE
Combination V Pulley Drive and Brake
Firsten without wheel Pulle 5 3 50

Fob. Desirators, or old 18% for Prepaid Shapment in U.S.A.
OSBORN WHEEL CO. Doot PF-2 115 50. Rule 91.



ONLY \$46.00

RUSH ORDER

SHARPEN ANY LAWN MOWER from 5-inch Edger to 36 inch Power Mower in ten to twenty minutes with a MODERN LAWN MOWER SHARP-ENER because dismanting is unnecessary - neither handle, roller wheels nor motor need be removed the MODERN when sharpening any mower SHARPENER eliminates all band filing, it precision grinds to the extreme ends of both felt or right reelblades. Bottom knife is held in same brackets for sharpening, NO EXTRA ATTACHMENTS! Order today! Price \$241.50 (less motor) fo.b. Pasadena (V) or 14 H P single phase motor recommended to

Modern Mfg. Co., 186 N. Fair Oaks, Pasadona 1, Calif

MULTI-PURPOSE, RUGGEDLY CONSTRUCTED

FLEXIBLE SHAFTS

Plus Protago

Souled Against Oust & Diet \$31/2" Longth, %" Diameter (G.D.)

These MAAFTH can be used on by declar stuff or by centuring the coupling in a chuck up to by conscity fluct eite on operating and in by diameter 1st beyond her lock Speed come. "25 these or lock Speed come. "25 the to be best or located to speed to see it can due for working a hand to get at paces tules covering of pit reasons. Floattend Of p.l res stant Mountena Unertain for many purioses the adding hubing Original Power Orthing and Transmission of Power

HOW AVAILABLE EXHAUST BLOWERS

Pentilate Loui timer Store, Booth Routt, Dark from Lainters eit Furnete ust alen.

A Better Blower FOR ONLY

 Quiet operating e 100 cs. ft. per min, capacity e A.C., 110 volt, 60 cycle

Sturdy construction, light weight Complete with cord and plug



ELECTRIC TRADING CO.

212 CANAL ST

NEW YORK 13, N. Y.

Electric Fane & Blowers in most alsee for every instacted tomosercial and Comments use Table Saws Air Compressors Freetrics Tools & Faint Spray Equipment in stock

WATTE FOR CATALOG "S"

COMPRESSED AIR INSTANTLY, Anywhere!!

fortable Air Compressor and storage tanh Russedly built of test materials using forting juictosted build bearing on connecting and and of impresented main bearing on shaft I now as design for yet of mention valve crouble the most common fault in air compressors. PATENTED unique air in tink every in air compressors partered unique of the tink everyon to their sit outfield is much presser (has that form larger compressors newered by hearies motors \$10 ft live appears mare y 1300 on inches of air bet foliute si mp his hed occasive of 10 has de will shale \$90 to truck the in less than one minute. Comes complete with 100 to

Thurs 4 though hader tip ad actions allows setting of auput present at any value which will automatically be many tilled within from any 4 H P moint thefa for appaying paints or lacuages of informatic losseticides annealing or bearing with hatural cas information the or Price # 4 50 Postage freband above in the to 2 Afficient completely and estable appears type stray gun ninn six with 15 ft. of 1 in the leased book six affects only #7 75 with plot rosts. Fer also brepaid .5 required on all C to 0 orders. Send for free cats upp of radio parts and surplus flows.

BUFFALO RADIO SUPPLY: 218-221 GENESEE ST., DEPT. 25, BUFFALD. N. Y.

MITERING GENTER GUIDE FINDER handy 2 DIAMETER 6 CONVENIENT tools in 3 ACCURATE

Mitter Master takes the place of an expensive miter box accurately set to any angle. Scale marked for mitering 5, 6, and 8-sided frames. Steel construction.

Built to last a lifetime. If your dealer can't supply you we will send it postpaid anywhere in the U.S. for \$2.00, (Foreign \$2.25), Unconditional guarantee. If not satisfied within ten days for any reason whatsoever, your money will be refunded.

MASTER SPECIALTY COMPANY

FEB 273

SENSATIONAL NEW LOW PRICED RADIO



The Amazing RADARADIO **Developed by Army Radar Branch**

A1 3 3 11 parts a result; iterent radar steretop men a prake this set unique Enjay your favorite rada set o broad as a whole set thing where it is to be set of the set of the

SEND NO MONEY LIMITED SUPPLY

Order your HADARADIO today Lamited number available new of special low price of any 16 36 per available new of special low price of any 16 36 per available complete with earthogs 1600 NO MONEY Upon delivery pay quartern anily 60 98 plus postage (O.D. charges is seen 380 De up to order for great paid delivery wat sleet a post very puse entend ar cellula to 10 days for refund 1 m feel dupply post in 10 days for refund 1 m feel dupply post in 10 days for refund 1 m feel dupply post in 10 days for refund 1 m feel dupply post in 10 days for refund 1 m feel dupply post in post in gast be the ENVY of everyone in your restability.

AMERICAN MERCHANDIAME

AMERICAN MERCHANDISING CO. INC. 32 Ademy Avenue

Dogt. PS. AW.

piete

Montgomery 4 Alabami

FEATURES

Conventional alide rule dist CHES NO clee

NOTHING to went

NOTHING to ad-

MADE FOR DOC fect lifetime

OLABANTEED FO caption when

Not a Loy noth-

ing to steemble

ivedy

Da Herry

tricity.

14 Deca

aut

| Unl

Direculo

COLIMETER SLIDE VIEWER BABY SPOTLIGHT SLIDE PROJECTOR FIXED FOCUS MICROSCOPE

ALL-IN-ONE only



With the extuable parts found in this famous B 29 Air Force Gun Sight you can burld all these ttems plus many more Composed of more chan 25 expenmive parts . . . all top quality construction, precision made for finest accuracy and dependability Possible adaptations are endless and fascinating, Free cooversion sheet with each order All new in original cartons. Worth many times this low price.

RUSH YOUR ORDER TODAY! B. & B. PRODUCTS CO.

111 W. Jackson Blvd., Dept. PS

Chicago

Make Your Own RUBBER MOL amazing New Method!

Now an assazing new method to make your own flexible rather molds to recast sculptured annuels or judgerts. Dun lease stugly or in quantity expensive original subjects at amazing any cost Reproduce stanceties, plaques or any other mode a neit putface. A th this new topical runties age.

Start this fracinating hobby PROFITABLE HOURY | That unlead obeginning of your own hughness. Par in this beet cents ea it make handreds of our ner la react, at tity ound, proves Empy to start. But that of subjects you can reproduce,

SEND NO MONEY!

Just your name and address for BIG INTRO-DUITORY hit con along 14 different stems everything you need to work with neighbor famous in his model Pay por man only \$1 49 plus C O D pur age. Money mark if out an affect. Or save (O f) by sensing \$1.49 with order and we pay postage Welte for PREE CATALOGIE

NVBBEN-FOB-MOLUS = 5044 N. Arondatu Arongo, Dopt. 48-87 = Chicago 21, III.

The Wheel of 1001



Rugged steel disc wheel solid rubber tire. Electrically welded Ideal for building or repairing Tiny-Tot ventcles A light wheel with great strength for countless other uses 41," diam Fits 4," axie, PRICES. Only 75c each, \$8.40 a doz. Post-

IMMEDIATE DELIVERY

ON THIS DELUXE WHEEL

For eralismen wanting a better wheal here's a beauty Air cushion, puncture proof rubber tire. 2" thich is fi diam The lating Walton I a I wheel equipped with a prevision type '6" relier bearing. Unity \$11.80 for \$1.80 fo

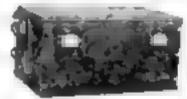
WALTON WHEEL CORP.

Dopt. 84 Millimoukoo I, Wisconsin Sax 432 Dealers, Jabbers, Salesman wanted.



Your Own ELECTRO-PLATING Business

rofitable-Simple-Pleasant



The VARS-PLATER ISE V. A U place of elect or rubber land and electricals which are news a switcher and accompanying handless, that is likelisted and rany to universitable, will give you many mency meeting apportunities.

You can PLATE Gold Street-Christian Nicke Laprer Carleston, with the VARS-PLATER.

FERR

Write today for descriptive Riscoture and

EWIS ELECTRICAL MFG. CO. 1200 V. Rughin Ty.



SWISS MUSICAL UI

Ready to install in your own box, Choice of waltz operatio or cassescal \$4.50 each. Postpuid if cash with order Literature on request

Music ber reputer invited.

84.50 em

Assembly & Repair Co. Dept. PS, 303 Third Ave., N. T. C. 10



Make beaut for objects of Flenglas, Litchia Cara in also say one or home Jewelry novel er a stream in Send for new 10 000 word manual on how to fabricace weld and el es arresser les form latest plastic materia a in home workshor Hundrests of tract pal suggestions.
Written by teading plastics engineer Price
pressive 35c examine or coin to get Price
(pformation and price let covering transparent plas(pformation and price let covering transparent plas-

le shorts and tubine ut to your sar Write todays NOUSE BEAUTIFUL PLASTICS, Pupt. 84, 5334 W. Marrison St., Chicago 44, (1).

POPULAR 274 SCIENCE



VEST POCKET SIZE!

Fits vest pocket or purse. Quaranteed Accurate, Operated as casily, and as reliable, as machines costing many times as much. NOT A TOY OR GADOET Substantially made of 28-gauge steel—guaranteed for tife against defects in construction Beautifus looking modernized design Finished in Black, Silver and Red. You positively can I buy a Calculator of equal quality for as little money ACCEPTED AS THE FINEST LOW PRICED CALCULATOR POR OVER 30 YEARS' Operates with a flick of your finger Adds subtracts multiplies, divides—counts up to ten multion, Pays for itself over and over in matakes avoided, and time saved,

MAKES IDEAL GIFT

Baby Galculator makes an ideal gift—for every Gift occasion, Birthday-Graduation Christmas Anniversaries For men, women, children—teachers, business people, home or shop ose COMES PACKED READY FOR GIFT WEAPPING.

TEN DAY T IAL

Money Back Guarantee

Because we know that our machine is the very best calculator to be obtained at this low price, we make this 10 Day Trial offer on a positive money back guarantee'l Don't buy ANY Casculator without this guarantee. Send only name and address, pay postmen \$2.50 plus postage (If cash is sent, wa pay postage you save up to 40c (If outside U B., send \$3.00) Money back within 10 days if not delighted,

(AGENTS WANTED)

CALCULATOR MACHINE CO. (Mfrs.) DEPT. 475, P.O. Box 248, GLENVIEW, ILL.

CALCULATON MACHINE CO., (Mfr.) P. O Bax 248, Dapt. 475, Gloaview, 1H. Your Calculator is just what I've been looking for, Bend one at once (U.O.D.) or (I am encoving \$2.50)

stter Built Lower Price Safe Boats With Full Longth Spray Rails Keep passengers perfectly dry even at bish speeds. Catalog also shows two trees models of Take Along"
Bosts. Two big factories—
eave you fee ght.
CATALOG FREE
Write for rour every flatte kind of look in which you are interested.
THOMPSON BROS. Light doet for Ause MFQ. CO. IIII)

SEND NO MONEY

SURPLUS-NEW-CUARANTEED-GOVERNMENT INSPECTED

Four Useful Meters for repair shap, laboratory, home and form at a Sensational New Low Price

Veltmetter Richolt 2 ty" round, flush mounting 0-130 voice and at a for use on a 1 standard co-incress 1 replacates. Voltmeter General Electric Model DW 51 212" round flush minister Westinghouse 3 ty" NX 33, round bakelite case 0-1 M A movement black sea e marked "TW PA Plate PA drid & Battery Complete with Paper Vart thun M I lammeter Seale 4.C. Voltmeter Sterling a" ring mounting stamped metal case polytised vancuspe C 250 voits Direct Current and Alternating Current 5 % accuracy

All Pour of these maters can now be had at ONLY \$8.90 and Paid anywhere in the U.S. and Canada (ar

MARITIME SWITCHBOARD

Dept P.5., 336 Canal St., N. Y. 13, N. Y.



only 5225 Assemble Yourself

THIS STURDY SIDEWALK MODEL BIRK is ideal for children from 11% to 7 It's the CO-BETWERN bicycle—the important trainer to fill in the gap between tricycle and standard bicycle models.

LITTLE GIANT is built to take punishment—it's sturdy, solid, safe and easy to ride. Guaranteed to carry 500 lbs., adjustable seat, handle bars and sprocket. Self-lubricating aprocket bearing Ball-bearing wheels. Semi-pneumatic, puncture-proof tires. Regular bicycle pedals. Chain guard Length, Il inches from axis to axis. Wheel and tire, 10 by 12; inches.

LITTLE GIANT can be shipped to you at this great money saving only because it comes ready for you to paint and assemble. Pull instructions for assembly—complete kit including Allen wrench, Decale, etc. starte

complete kit including Allen wrench, Decala RASY ASSESSED T GUARANTOOO! Deuter inquiries inpiled

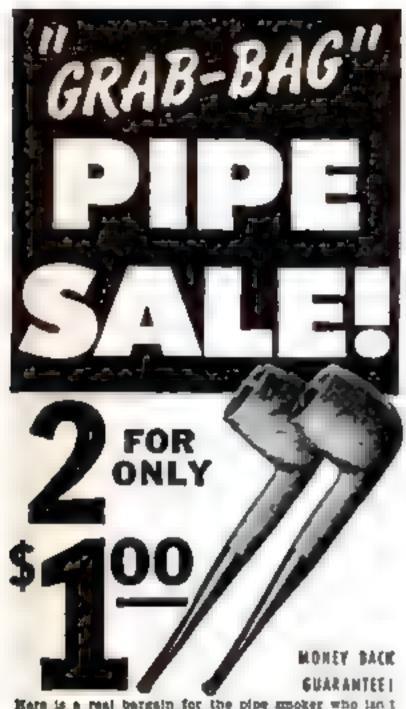
a er glene b

2407 SOTH ST., N.W., WASHINGTON, D.C.

Gentlemen: Ship me at once the LITTLE GIANT BICYCLE ready for assembly, with kit and full intirections.

Seed C 0 D. I will pay portains \$22.50 play shipping charges. Dencissed find thock or m.a. for \$32.50. Shipping charges will

Maste			
AAAren:			
C#r	Zone-	State	***



Here is a real bargain for the pipe amoker who isn't too fussy about the appearance of his pipes, but will is primarily interested in their smoking qualities

These bargain pipes are of all kinds, chapes, sizes and woods Some are good he imported briar domes to briar, degwood and moded briar Some have imperfections in their fit sh and some are sightly chipted BUT ALL ARE SMOKABLE When your order comes in we will just grab two out of the box and you may get a bigger barge n than you expected But if you are disappointed, return the paper for full refund.

SEND NO MONEY

Remember if these pipes were perfect in appearance, some of them would cost you \$1 00 to \$3.75 each This is a "grab bag" sale, and this offer may never be made again. Send \$1.00 with coupon, or we will ship O O D plus postage and delivery fee. We guarantee satisfaction or money back

FOSTER PRODUCTS, Dapt. 2PS 257 4th Ave., New York 10, N Y. Please send me 2 of your grab beg pipes as per your offer if I am not satisfied, you agree to make refund.
☐ an elect \$1,00 ☐ Send C.O.D. \$1.00 plus portage
NAME
Street
City
Zona 1
State 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1



8 complete plans of toys trays, garden arnaments, Dutch

boys and girls, what hot shelves, and many other interesting projects Finest selection available.
Novel method allows you to make finished project may size desired FLUS FREE DeLuxe Plan of corner shelves Send only \$1 to
Jackson, Dept. 3, 5440 M. Shersing Ava.,
Milwanker II. Win.

276 SCIENCE





-9" 2 3". Solves any Ohm's Law problem with one setting of the slide. No slide rule knowledge necessary. Send 25c in coin for your Colculator OMMITTIMES. CO., 400 Flourney Street. Chicago 44, Illinois

\$25 va us assortment of Co.is Condensers. Transformers Resistors Controls etc. An experiment-MARKO SUPPLY, Dept. PS-2

2924 Legen Blvd.

für brings the new 1847 sempletely lifestrated satalus . . . Contains bundreds of new ideas, new items and new few prices. See the new kits and bulk assertments, shorts, dyen, rements, etc. Also information about authund auch prize sentest.

BELLOO PLASTICS, INC. 96 Gramatan Avenus Mount Vernon. H Y . Dept. P1



PRESTO E EXTINGUISHER

Mighty Midget Puls Out All Types of Fires \$5.95

This tiny, miracle fire-killer fits easily into the paim of your hand. Just 6 x 1 \(\frac{1}{2} \) inches. Weighs only 10 ounces. Ready for instant act on One half turn of the screw and PRESTO, the danger's gone! Can be used by any marries of the family. Ideal used by any member of the family, Ideal protection for car, boat, motorcycle, etc. Harmiess to food and clothing. A tested and approved fire extingulater

> For immediate delivery send check or money order for \$5.95 and we will send you Presto Extinguisher post-paid, or just send name and address and pay postman \$5.95 plus postage (C.O.D.)

INDUSTRIES, INC. Pearl Street, New York 7, N.Y.



Car Owners! Meet Master Glaze—the sensationally different luster for new and used care! Not a wax — not an oil polish — not a paint! — nothing that "smears" over the surface.

An nauseel apportunity (Quick, fleshy demonstrator. Big profits.

Good territory.

Declar Inquiries

Incited

MASTER GLAZE is a unique discovery — a creamy liquid —quick and easy to apply! Gives a hard. glass-like surface. Even gasoline cannot dull it! Lasts six months to a year! Amazing luster-beautifu), sparkling clean and brilliant! Doesn t finger-mark-doesn't amoun! A match box full glazes an entire car. Seals

FREE SAMPLE

Write today1 MASTER GLAZE CO., 7726-871 W. Harwood Ave., Milwacker, Wis.





PRESSURE-LOCK

it fits as it grips ... and it HOLDS!

Created by tool engineers in answer to a universal need for an all-around tool, this pressure-lock wrench grips nuts, studs, pipe, short, broken or irregular pieces and holds them with a 11/2 ton grip. Releases with the flick of a finger. Readily adjusted to varying jaw openings. Jawa alwaya parallel when they close . . . grip to the very-tip. Saves time, tempers, avoids dropped pieces, rounded edges. At leading hardware, auto equipment, mill supply, plumbing and electrical atores and departments.

7-Max, Jaw opening %"....... 2.45 # 9-Mos. jew opening 1" 2.95 #11-Mail. jaw opening 11/2" \$4.60

■ BMC CHANGE - A - BLADE SCISSORS — Really 4 sc ssors in one-gives you new, keen blades in 0 seconds

★ Offset Screwdrivers—for both Philips and standard head screws

★ Ready-Ray Trouble Light—plugs into the lighter socket of your car

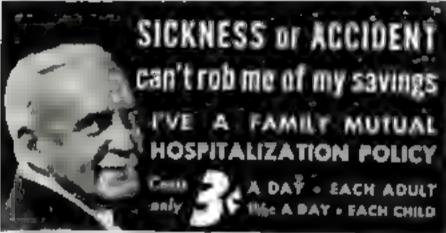
NUFACTURING CORP. nghawton, N.Y.

A PENNY BUYS

Go places for penales . . . with a Whizzer Motor on your bike! This sturdy, modern motor fits any balloon tire bike . . . takes

you 125 miles per gallon, at speeds up to 35 m.p.h. It's America's thriftiest power transportation, engineered for years of trouble-free performance! Get in the Whitzer Parade!





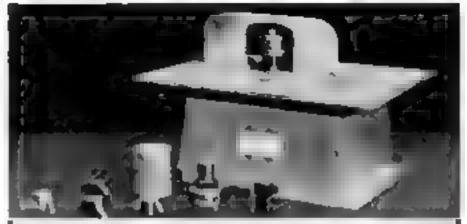
Benilt's logic bis day our enter a bargers
POR MCEMBER SIR ACCIDENT
Respital Expenses poid, up to \$540.00
(heginning with the first day)
POR ACCIDENT
Bector Expense said, up to \$138.00
Loss of Wages releatureed up to \$300.00
Loss of Life by Accident \$1000.00
WAR COVERAGE AND EXTRA BEHEFIT'S
Childbritt Expense poid, up to \$79.00

Bickness or accident can easily wipe out, in a few weeks, eavings it may have taken years to accumulate. Don't let this happen to you. With a Family Mutual Hospitalization policy you if he able to pay your hospital bills. In case of accident, you will be reimbursed for your doctor expenses and for our of time from work. You may choose any hospital in the United States and your own family doctor may attend you. Benefits applying to children are 50% of those paid adults.

MAR, COUPON TORAY---- No Agent Will Pether You

CARLLE MULLER LAS AND PRIMARCE CO., WILMINGTON SS, GEL

Family Mutual Life in 601 Shipley St., Wiles	surance Co. 85-13 ington 99, Del.
Please send me, withour Bour Benganical Hour	ul obligation, complete information on italication Plan.
MAME	
ADORESS	



WOOD SHAPER

Of grey from and all men im construct on High speed New Depart re Bail Blanks, 12 x 16 neh tune with high speed.

THEFF WAY ADJISTMENTS Tabe all stable on the applie. Fence a strainer on the file.

Pequities to a higher notificated earlier with a raise disper head at \$ 7 in hard at a raise rheads \$6 00 harrounds to his an er head on request and according to size and pattern

Immediate Delivery-

MURPHREE MANUFACTURING COMPANY SYLCAUGA, ALABAMA



Sharp spiral blade news in any direction. Cuts wood, plastin, or light metals without binding or breaking. Stordy sized fitner, with new lever adjustment, keeps tension right. Complete new with 3 exira blades, 95° Blades only 3 for 25° Get yours today. AT YOUR NEAREST HARDWARE STORE, or send \$1 direct for memple to

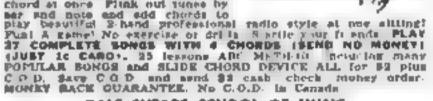
TYLER MANUFACTURING COMPANY

958 Pico Boulevard — Santu Monicu, Cultiernia

SPECTION OF SLADE

Play in One Hour by Ear and Note

MEWLY INVENTED SLIDE-CHORD DEVICE. First pieno. Play any chord at once Plak out tynee by mer and note and add chards to



DALE SHEARS SCHOOL OF MUSIC

Strelle 4102

Struthers 3, Ohle-



A TREASURE CHEST FOR MECHANICS GARAGEMEN — FARMERS — EXPERIMENTERS



100 POUND HANDY ASSORTMENT \$ 895 SCREWS—NUTS—BOLTS WASHERS—RIVETS—SPRINGS

Think of it - this popular assortment specially priced at Think of it—this popular assortment specially priced at less than 9¢ a pound! Chest filled with 100 pounds of clean, new fasteners, mostly 14° and larger diameters—bound to come in handy in shops, garages, on farms, or wherever a large variety is needed. Chest, too, is valuable for many uses after original contents have been used. Shipping wt. 115 lbs. Price only 58 95. Enclose remissance and shipping charges when ordering.

HUDSON TRADING CORP.

Chicago 10, III.

ATTENTION AUTO OW

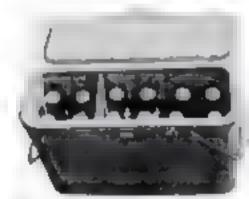


New Power, Pickup, Pepi America TYPHOON BUPER-CHARGER is back again, ready to put new tife into old motors, add to power, pickup, pep. 41 000 users find gasoline economy you will too Mutor knock venishes Grosse bath etr cleaning keeps dust out Takes 5 minutes to install with screw driver fits on

carburetor Order today mention make end car model Only

TO DAY MONEY BACK GUARANTEE! PRODUCTS CO. BOY & Engineery Blidg.

Here's Your Best Pal-



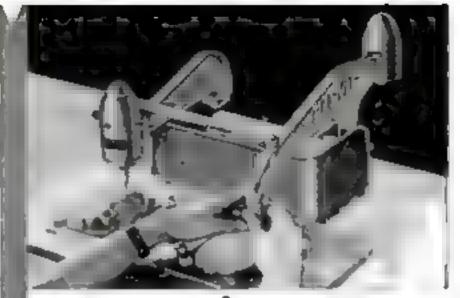
BEVERATOR

the insulated Carrier—for Beverages and Food

Keeps food and drink HOT OR COLD for hours Ideal for motorists, travelers, sportsmen truck drivers mothers with children, etc. Light, convenient sanitary holds a lot. Easily kept clean Made of Cadmium plated steel, efficiently insulated durably enameled Beautiful green exterior finish, Length 18' Width 7' Height 12' Shipping weight 11 .bs. Everybody wants one Only \$12.50 each, cash with order Add 50c for prepaid ship ment. Order NOW.

THE REVERATOR CO.

8th & Myatt Stu.



Amazing New DUMORE "CARVIT" Makes You a Skilled WOOD CARVER in Twenty Minutes!

A fascinating new hobby, complete in I tool!

Making fine wood carrings with a Carvit in so simple a chi I can do it! You can among your friends with imited work on your very first attends. You can and a 'resteen mail' touch to other mondworking projects by embeldshing them with line carvings.



Fascinating Fun—and Profitable)

The Carch is a duplicating tool made by a famous manufacturer of precision in untrial tions. With it you can only descent of brant ful and useful objects in manageny, shony, and other fine woods. For models, the can use pla sea, costante levelty achieves, and a wide variety of elier mexpets a objects of planter metal plans and planter to the properties described and the first of the costant planter of the costa T lok of the useful and orominental

things you can make for your teen house the althink of the

You are an expert at ence—with a Carviti

Here's how the case to-use Carrit. note You camp a model to the table below the tracer, and a wood block below the cutter Then you salted on the miter and commerce of your hardel. The cut-ter merce with the tracer to carro an exact dupl cate of must andel. That's all there is to it!



With a center attachment you can

Carve objects in the round sometter, burts, and figures, The Carett comes complete a th cutters, wrenches, and instructions, ready to use, for \$18.50, Center attachment

Production is too limited to supply your local dealer, but a tile our took lasts as can accept your deep order for immediate delivery. To avoid waiting for your new Carrit,

fear e	aut this coup	on and mail t	oday I
THE DUMO		, Dept. 8-52, I	tacine, Wis.
10 DAYS	Please aread		
FREE	D One Cital	t complete an de	seribed above.
Teloff	Carvit.	information or	the Dumore
(If I am no return II in these price.)	10 days for a	tistled with my complete retund	Carvit, I can i of the pur-
D Enclosed, 1	la sur chreit er	money order, b	s the amount
		new and postupy,	
Name			
Street Adding	£8		
Cily		() Sta	te

25 Asst'd CUTTERS, SAWS REAMERS, BORERS



If you can duplicate this wonder value in any hebby shop at less than \$15.00, return your set and get your money back,

This is the greatest value we have ever offered - 25 a scorted haidened atecl cutters for working in

Assorted shanks 3 32 7 64. and 1/8" diameters. The large illustration shows the



UTILITY MOTOR

Can be used for running tools, toys, expuriments work etc. A series wound motor 3 ," tong x 21 ," wide and 12 ," high to shaft A resistor to included

at no extra cost making this an AC DC Motor Both above items Post Pold In M.S.A. and possessions

GENERAL AIRE CO. 147 W. Marie S. P. Co.

40 POWER TELESCOPE

Finest Achromatic Lenses. Bruse Tubes. Lenther Covered Main Section.

Variable Power Lyapiren Adjustable from 10% to 40X Lower powers for target spotting and wide angle viewing Higher powers for one range and astronomy Achromatic ob-ective and astronomy Achromatic ob-closed 51/2" open 27". This is a precision American made instrument. Only 334 50 Postpoid.

LABORATORY MICROSCOPE

\$19.50 A professional type inicroscope priced within the seast of the amateur For school physician and the serious Co or corrected achromatic laboratory amateur lenses Professional site eyepieces and objectives interchangeable with a standard professions makes Height 14 inches Weight 314 the 2 wheel focusing Body tists nov one e

Price complete with 75 power

vice complete with 240 pawer

Price complete with 800 pewar .925.50 optics . . . + +

We pay the postage

Money Back Guarantee

BROWNSCOPE CO.

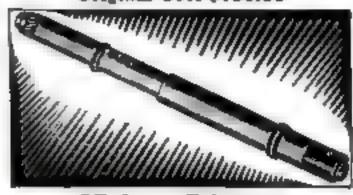
LIFERENSER

24 West 45th St., New York 19, N. Y.

BINOCULARS MICROSCOPES

BARGAIN

Original Cost \$150.00



3X Army Telescope

ALL COATED LENSES—BRAND NEW

An idea Bift for they be a cold library as assistance wie The high resulting power of the six costed lenses five of ter ig all great details. For the experi-Of page another one of a six men's at an he dismark oil and good for highdreds of projects Tength 331 a motors. Postpaid 57 50.

\$66,866 Lances and Prisms. Soud 3 Cati Stone for "BARGAM" List. A. JAEGERS, BOX 84B, 50. OZONE PARK 20, N. Y.



Now make generous afficies with Instante arrapto are used plantic Einhed flowers, insects,
solutions. Nake 18 8 2 1 hillions from rounteas often a of breaty hard him fault is comes
elebe or enter in suit faber. Naw dels or enter
the bare fract that appears parter glade for ask
that the Hame Project Manuas now ready Shows how
that facilitating consistely new field Have figure
to get into facilitating consistely new field Have figure
that the facilitation for the CARTOLITE CO.,
South Rd., Sat. 311, Remissions, III.

HANG THAT DOOR THE PROFESSION

USE THE TIME SAVING —LABOR SAVING

E-Z MARK BUTT GAUGE

COLUMN TWO AND CET THES @ Nong more dears betterYou get a clean cut deeply erched profile Remove chips, Repeat this operation on the THAT'S ALL-NO MORE!

· No adjustments · No retarn. Used and approved by Master mechanica.

Comes in 312" and 4" istandard: stars, & Precision made.

Cost ONLY \$1.75 each or \$3 00 a set at your hardware store If your Dealer can't supply you send only \$1 00 with order and pay Postman balance, plus postage C.O D.

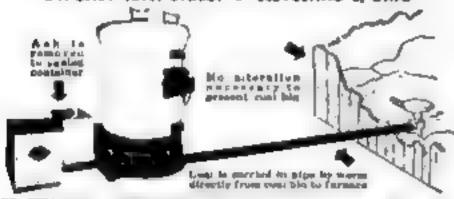
Leatherette case

E-Z MARK TOOLS • P. O. OOX 0377 • LOS ANGELES 10, GALIF.

STOKER EMPTIES OWN ASH!

A remarkable stoker already used by thousands of home owners-fits into any furnace or boiler. Manufactured since 1934. So automatic it takes the coal from your present coal bin through a pipe to the furnace, going around corners if necessary. Keeps house at even temperature, empties its own ash in sealed containers, no coalto shovel, no clinkers to dig, only bituminous stoker of its kind on the market. Send for full information NOW!

POCAHONTAS FUEL COMPANY INCORPORATED 341 EAST 131+1 STREET . CLEVELAND & OHIO



esting Lines. From blan' type energ self-can afted a t a side for up to 2 hr undernated obeta loss. Not a gadget but his newest thing in fibe. Its ne equipment for shallow water talkage. pulse emitted in expression and about his use fither a goder shades and deep kater rige Welle

GUYBOARD MOTORS New 10 33 H P Beloturks size him morning

BARGE PROPULSION UNITS at implete self. culting need multingraft must be mount. The our deck---10 II C and 1 5 II P. LIGHT PLANTS, lofe Preservers, Betle Bertania,

Binorphet, Rubber Bonts, Are pur on any mothing forty

E MARINE SUPPLY CO. P. O. SAN SOLI-O

OPERATE Profitable Lifetime Business Sell-

Seffing \$100 (tems.) POWELL CO. DEPT C

ing Merchandise by Mail. Large Profits on Fast Selling \$100 items. WRITE TODAY! SHARLMER BLOG CEFFELAND J. OW



With FOLEY

Offer metades 2 books from Fabruston Manual & Goald Caralog lossing the man contphoto stack of Plants, Marrially Assertation, Turk

ON PLASTICS, INC. 19 W. 21st St., N.Y 10, N Y

RETOOTHER

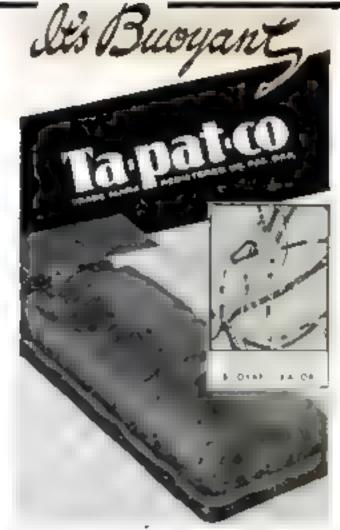
For All HAND SAWS

Cuts 26 stres of teeth from 4 o 16 posn's per inch immediate delivery

No need to grind off o d teeth cut new Ulies oret Lhem Pas. accurate go eyestrain Cuts filung alme in half

FOLEY MFG. CO. 291 7 Foley & SK. Minnespois 13 Minn. Send to I de alts on Foley Setouther

Address



Millions of tiny oir calls in the soft KAPOK lining cradle tired muscles and protect you from the cold. A tough snog-proof cover turns away wind and roin. You can really s-I-r-e-t-c-h out in To-pat-co. A big, roomy foot pocket lets you rest "toes up" without cramping or binding.

To-pat-co gives you all the new comfort features, yet rolls compactly and carries lightly. See it now at your sporting



try winds can't bite through the warm lining and water reperient, shag-resistant cover of a Ta-pat-co Parko Pull the hood over your head and

you're as soug and warm as a bundy in his butrow It's the toughest, lightest, most comfortable autdoor garment you ever stipped into - and one you'll love to wear.



THE AMERICAN PAD & TEXTILE CO. Dept. 8-1, Greenfield, Ohio

tany used 10c in soon or storight to

CAMADIAN SHANCH CHATHAM, ONTARIO

WORKBENCH

Built to Last a Lifetime!

With Bottom Shalf and 18" Sq. Drower. 2"x6", Solid Plank, Greaved and Dovetailed Top and 1"x8" Back Roll, Skellacked to a Smooth, Salley Finish.

Sept. 34 | MOHAWN LUMBER CO. 14525 W. Chicago Bird. Detrait 27, Mich. Enclosed Check Money Green In S.
Ship Gires William BENGHER at

\$16.55 mach, F.O.R. Debuit, Mich.

Sond C.O.D., 55 Deposit Enchand.

ADDRESS

No Priority Meconary!

Pt. Long # 34" 16gh # 26" Doop. Shipped Kanck-down, with Bolts, Note and Screws and ABC Chart for Quick, Simple Assembly,

MINGH ST, MICHEAN



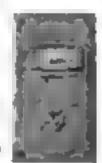
Order, or 1958 Sh C. O. D. (55 Depart)

SURPLUS BARGAINS

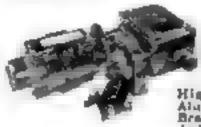


Valve, Type ABA. 0 to 3000 lbs. Used con-Wt. 2 lbs. 99c

Electric Fuel Quantity Gage, used condition, minor damage Four scales Msc ewitch, e.ec-tropic parts etc Weight trunic parts atd Weight 1be



Righ Speed Motor, Last. 11000 rpm, 24 voits DC, 1/4 HP Has gear box, junc-Brand New! \$3.98 each Wt 6 lbs. . .



High Pressure Aluminum Verve Brand New! Two Jube fittings.



NO COB'S. INCLUDE SUFFICIENT POSTAGE OR WE'LL SHIP COLLECT. AERO INSTRUMENT CO.

Municipal Airport

Houston 12, Texas

Write Your Name

with ordinary pen, in Beautiful GOLDEN RAY LETTERS

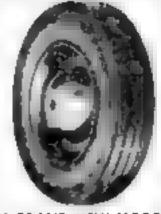
which look and feel like Expensive Engraving. Make your Greeting Cards and Personal Stationery.

GOLDEN BAYS PROCESS KIT Complete with Gold, Silver, Copper Metallics, Order Now \$2.00 Postpard. Agents Wanted-Large Profits.

TROY T. DAVIS

P Q. BOX Z

BRUNSWICK, SA



A BRAND NEW MODEL Just off the rendertion Deluxe Whee, Progrums proof heavy number tire special type collect Fitte ONLY \$5 50 not of 2 . . . \$10 80 set of 4.

USE THE FINEST

MONEY CAN BUY!

Your wheeled project deserves the very best in wheels. And here it is . . . a heavy-duty industrial type steel due wheal (weight 5½ lbs.) with a 14" praction type roller bearing... an air cushion puncture proof rubber tire 2½" thick 10" dia. The tire thick arries a toad of 200 lbs.! Priced at only \$29 95 a set of complete Send money with order. No COD's.

WALTON WHEEL CORP. Dept 25 Milwaukes, Wis. Ben 432 Dealers, Jobbers, Balesmen wented.



GUARANTEED CAR SERVICE PRODUCTS

M. A. W Memeter Seel-repairs leaky radiators [mmediate y K. A. W Metallie Seet and Me-chanical Method-restore cracked heads and blocks to unimpaired service in just a few hours. KERKLING & CO., Berbank, Celifornia.



TOOL HOLDER

for

Chisels—Punches Star Drills



Old Dongsroes the spring action takes up the st my of a third erted to aperate by the way of the standard or a local trains aperation releases tool being used



New Safe Way

Send \$1.25 To BERGGREN, Mfr., Wadena, Minn.



'ARIABLE SPEED DRIVE ATTACHMEN

The Era Variable Spe Drive enables the operator to provide correct speed for large or small drills by a convenient method of shifting a lever,

Designed to fit all poutar makes of presses. In-stalled in a few minutes, without drilling of holes or changing present equip-

Furnished with either bronze or ball bearing oul-ley, complete with belts.

When ordering be sure to specify make and mod-el of press, also type of autley desired.

> WRITE FOR INFORMATION on other makes of presset

Minimum and Maximum range of speeds

Atlan 15 or 330/7780 Graffiaman Balce Comes (5 275/-0000 819/9300 Buffale 15 Canedy Otto 18 Delta 14" L S. Delta 14" H S. 4 0/9250 330/2240 Walker Turner 15"

L S. Walter Turner 14" 300/2100 679/5509 И 5.

Prity - above Bronze bear-ing \$39.50, Bail bearing, \$45.50

obtainable, as follows: Buffale III Deita 17" 350/4400 Did Model Dolta 17" L 320/2400 New Medel Dolta 17" H E. 230/4100 Did Medel 640/5000 Delta 17 H New Model 480/6430 Walter Turner D-1100 H 3. 168/2680 Price - shows Bronze bear-ing. \$45.00, Ball bearing.

Special Model for Light Duty \$27.50 and Home Workshop.....

ERA METER COMPANY

3342 N. Kilpatrick Avenue CHICAGO 41, ILL





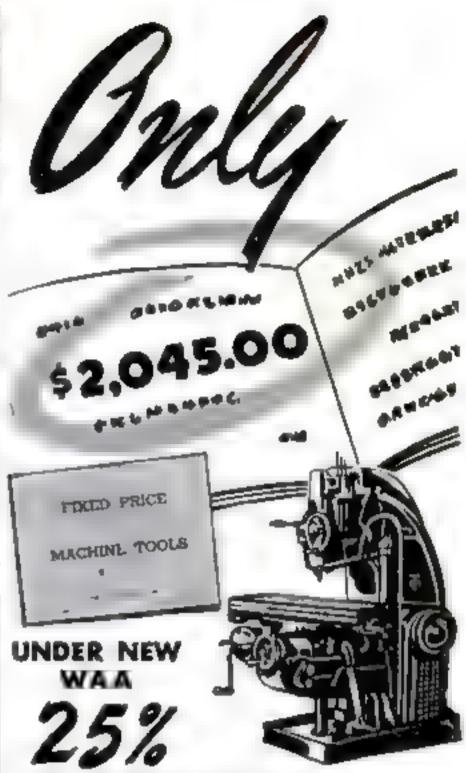
\$9.34 (tax included order and we pay postage WRITTEN GUARANTEE WITH

EVERY WATCH If not denot been tampered with, Hurry-order now-supply limited! A fortunate purchase makes this amazing offer RUSH! possible They won t last long at this sensa-tions, low price We urge you to order now while the supply lasts Prices are going up Up and UP every day order now-this offer to made only for

Plus 10% FED. TAX

Quick action se es AMERICAN MEKCHANDISING CO., INC.

Dept. PFW-48, 12 Adoms Ave., Montgomery 4, Ale.



BELOW-MARKET PRICE SCHEDULE

Here is a real bargain in surplus machine tools for general production purposes. 31 major types of toolsin all makes and models have been recently repriced to an average of 25% under the open market for the same machines—in order to clean government warehouses faster of this surplus property. The tools average less than 5 years old. Few need rebuilding but when necessary it can be done at a cost within the large price differential allowed. Find out today about these burgains for yourself or your company. Write, wire or phone any of the WAA offices listed below for your copy of the fixed price Machine Tool Catalog—issued October 1, 1946 . . . or ask your regular machine tool dealer to show you his copy.

686-2-A ADMINISTRATION

OWNER

SURPLUS

ghipin - Brotter - Charleste rgo - Charlestell - Christian Bullin - Durver Beardt Furt Worth - Relana - Revolve - Jackson-ulle - Kanser City, Ma. - Little Both modic Nucleville - New Orleans New York Owners Philadelphia Perland, Orc. - Elchmond - St Louis Salt Lahn City - San Autonia - Sun Francisco - Statio - Louiston - Tuba



RUGGED! COMPACT! HANDLES BIG WORK

Thousands of owners find fun and profit with the Universal. Patented design gives you the five most pacful power tools in one HEAVY fabricated-steel frame. Runs free in bronze bearings. Ideal for home or small shop.

LATHE-30' between centers. Face plate, spur center, tool SANDER-outs fast and clean, 8-in, diam. regt included. duk takes any kind abrasive. CIRCULAR SAW-taking 6" to 8" blade. Arbor takes moulding cutters, scratch wheels, EMERY WHEEL - 5' - furnished. buffing wheels. FRESS—pulle up to 14-in. drlil in steel. 2" travel.

Write for literature. Shipping weight, 65 lbs. \$17.50 down, balance C. O. D. Ten day trial-prompt shipment. (Motor and saw blade not included.)

EMPICK INC. 1724C CLINTON ST., KALAMAZOO 24. MICH.





plete postpaid (endy to run with propeller and alcohol burner. Prices below do not include hull

Turbine, with LB- min, beller 317 90 Turbine, with 30- min, beller . . .

PHILIP STEVENSON COMPANY

Box 162, Station D

Cincinnati 6, Ohio

CUT JOB CO



Weight 245 the.

Retails for only \$44.50

Air Speed Saw and File eliminates slow, expensive hand hack-sawing or hand filing, Gets in awkward spaces with ease. Speeds auto-body repair, factory maintenance, aircraft service and dozens of other jobs requiring fast AIR SPEED IS DE-SIGNED for one hand operation Simple finger pressure adjusts the exact speed required.

For literature write:

AIR-SPEED TOOL COMPANY 1500 W. Slauson Ave. Les Angeles 44, Cellf., Dept. PS-14

PRACTICAL SHOP TRAINING in AIR CONDITIONING

Domestic - Commercial - Industrial REFRIGERATION SERVICE-MAINTENANCE INSTALLATION

Approved for G. I. Training

Write for Details

COMMERCIAL TRADES INSTITUTE 202 Sq. 20th St. BIRMINGHAM, ALABAMA

Train in the Magic City of the South -







FOR ONLY **AVAILABLE NOW** IMMEDIATE DELIVERIES \$

Designed to Do High-Grade Welding Inexpensively

Mointenance men, farmers, mechanics, machine shops, foundries, auto, general repair and job welding shops using the DYNAMIC WELDER find it so indispensable and useful that they cannot afford to be without it. If inexperienced you can easily learn to do a variety of highgrade welding jobs by following the practical, simplified operating and welding instructions furnished.

> WORKS ON IRON, STEEL, BRASS, BRONZE and OTHER METALS Has eight metallic and carbon art welding heat stages. Does work

READ WHAT USERS SAY....

Repair Shop Owner says, "It will do more than you say"

"I want to say I operate a repair garage and am more than satisfied with the welder. If will do more than you say." C. P., Butler, Ohio.

It's the Greatest Portable Outfit

"Flow I am equipped for all kinds of welding and I must say it's the greatget portable outlit for welding any man could ever wish to own. I wouldn't jull mine for the cost of planty welders I have seen which were very high in cost but not in convenience. You may put me an file as a booster of your wonderful welding product." W. J. B., St. John, N. B., Canada

Better Than I Expected

"I have done pulte a little welding with my welder and will say it is better than I expected. The arice, convenience, and variety of work that can be gione with the Dynomic are the attractive paints." W. R. P., Partland, Ore.

EASY TO OPERATE!

DYNAMIC SUPERCHARGED WELDL

Once you see a DYNAMIE is operation you won't want to be without it. Its simplicity will amose you in a year the DYNAMIC only costs you about 6c a day. COMES COMPLETE, READY TO OPERATE, WITH HELMET, RODS CABLES, ELECTRODE HOLDER AND OPERATING INSTRUCTIONS, ETC. NOTHING ELSE TO BUY, Write teday for Free particulars. Act new and get details on our amortingly lowpriced Dynamic Welder and 10-day trial offer

DYNAMIC WELDER CO.,

13 East 23rd Street GT, Chicago 16, Ill. MAIL COUPON FOR FREE DETAILS

DYNAMIC WELDER CO. 13 Feat 23rd Street GT, CHICAGO 16, ILL. Sand me free details of your 10-DAY trial offer.

City......Zonn. . State.







AMAZINGLY SIMPLE

TO OPERATE!

This portable Dynamic

Welder, easily corried

right to the job, can be

operated from any convenient properly wired

110 Volt 60 sycle

line. Can also be

supplied for 220 Volt 60 cycle oper-

> ction and for other voltages and

cycles of slight

cost.

additional

Reader

Unwritten Stories Are Also Important

A NEW YORK newspaper man once estimated that he read daily the equivalent of Gone With the Wind; for every thousand words read, he had one set in type

Here at Popular Science we likewise do plenty of reading. We also get in our share of traveling. In the course of a year many of us cover thousands of miles, make dozens of trips. Naturally, they don't all pan out. We don't expect that they will all result in immediate stories, but we do feel that some time the information gamed and new friends made will benefit PSM readers.

Over a recent 11 days, for example, a PSM editor flew 15,000 miles to Sao Paulo and Rio de Janeiro, Brazil, and return. He was one of 10 magazine and newspaper men invited to inspect the plants of Laminacao Nacional de Metais. After less than five days on the ground his thoughts were jumbled and his senses weary, but he had gained at least one new conviction: Citizens of the United States have no monopoly on the term "American"

As individuals and as a nation we have used "American" to denote much more than citizenship in the U.S.A. We have meant, too, resourcefulness, initiative, youth, fearlessness, adaptability, ambition and freedom. Well, Brazilians are like that too. We were astounded, for instance, to learn that the active directing heads of Laminacao boast an average age of 30. They employ more than 8,000 men and women, produce light airplanes, kitchenware, nonferious strips and plates, high-quality zippers, and steam boilers. Does anyone know an "American" outfit like that whose bosses are less than 10 years out of college?



Francisca Pignatori, 29-year-old Brazilian aviator and industrialist who heads the huge Laminacao Nacional de Metais, is typical of its young leaders.

The whole tempo of the expedition, in fact, was "American." The schedule of luncheons, receptions, dinners and especially interviews by the press left the guests breathless but impressed. The amiable, brisk, English-speaking hosts never once relaxed their efforts to exhibit their industries, dispense their hospitality, and show the incredible beauty of Rio harbor and the Sao Paulo countryside.

North American influence was unmistakable, even to the extent of a slight Boston accent in a young engineer, Oswaldo Barboza, who had studied aeronautical engineering at M.I.T. Besides designing the only light planes produced in Brazil, Barboza enjoys a particularly robust "American" sense of humor, plays four and five games of chess simultaneously, and seems to be an expert at bridge and poker. Others had studied at Pittsburgh and Cincinnati.

Yet for all the time spent, the very attractive new friends made, there really is no "story" for PSM readers in this trip. North American machines and techniques are different. For the most part, too, they have a head start on Brazil's whose problem is to produce more goods, more cheaply and more quickly. Brazilian engineers and scientists, able as they are, have different tasks from those they would have in the United States. They are essentially pioneers, because their frontiers are undeveloped lands and resources, like our own country 75 years ago.

- 750 NEwman

Th1 = On = P6KO-PX9-06GB



No moisture can seep through the seams of these raincoats—thanks to the electronic sewing machine developed at RCA Laboratories.

A sewing machine...without a needle or thread!

Since mankind first began to sew, say 15,000 years ago, seams have always meant "needle and thread."

But when thermoplastic materials came along—developed for water-proof coverings such as raincoats—"needle and thread" scams wouldn't do because of their tiny holes.

Now—thanks to research at RCA Laboratories that constantly seek to improve even "little things"—goods made out of thermoplastics are "sewn" by electrons and the seams are as strong as the material itself!

This will make possible dozens of new uses for these inexpensive and durable thermoplastic materials. Even today they provide perfect packages for foods, meats and drugs because they're watertight, airtight and transparent. You've probably seen thermoplastic raincoats, tobacco pouches, abower curtains...

Research, such as resulted in the electronic sewing machine, is reflected in all RCA products. When you buy anything bearing the name RCA, you enjoy a unique pride of ownership in knowing that you possess one of the finest instruments of its kind science has achieved.

Radio Corporation of America, RCA Building, Radio City, New York 20. Listen to The RCA Victor Show, Sundays, 2:00 P.M., Eastern Time, over NBC Network.



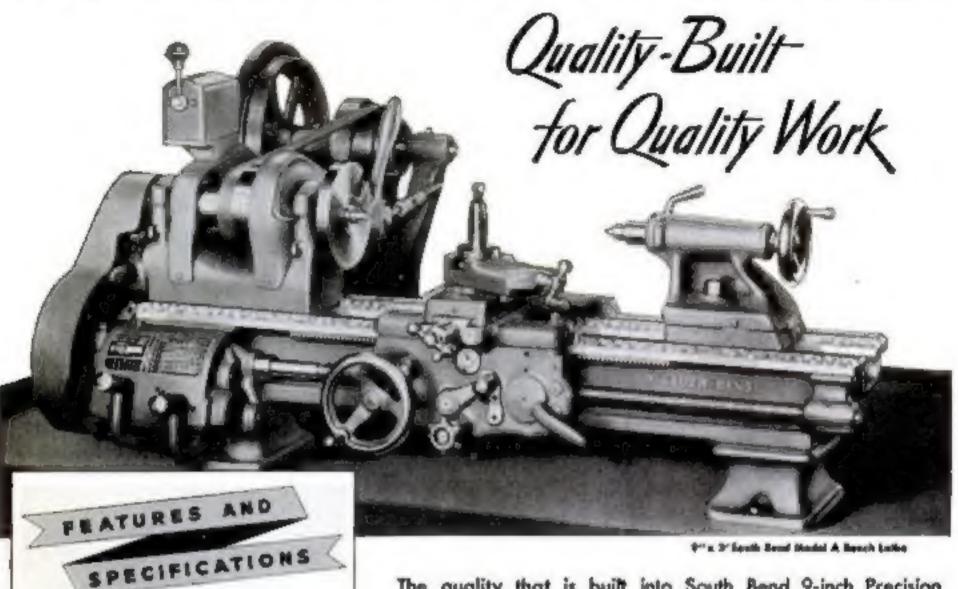
The electronic sewing machine "welding" scams. Anyone interested in manufacturing this instrument can obtain information by writing to RCA, RCA Bldg., Radio City, New York 20, N. Y.



RADIO CORPORATION of AMERICA

Carmal trel Instant

SOUTH BEND 9" PRECISION LATHES



\$" x 3" South Soud Hadel A Bouch Labo

SWINGS-91/4" over had and saddle wings \$1/5" over paddia cross slide

MED LENGTHS-2, 31/2, 4 and 41/2 feet

DISTANCE BETWEEN CENTERS - 16 to 34 Inches

SPINDLE SPEEDS-

depending so type of drive equipment

Sig -- 41 to 458 c. p. m. Twelve-41 to 1270 r. p. m. Sixteen -- 46 to 1176 r. p. m.

POWER LONGITUDINAL PLADS-

Model A Lethes-48, .0015" to .0053" Madel & Lathes-24, .0021" to 0155" Model C Luthes-14, .0021" to .0156"

POWER CROSS FEEDS-

Medel A Lethes - 48, .0004" to .0252" Model 8 Luthes - 23, .001" to .0046" Model C Lather-menual operation

THREAD CUTTING BANGE-Model A Letha-45 pitches,

4 to 224 per inch

4 to 160 per leich

MAXIMUM COLLET CAPACITY-1/2 feets

QUICK CHANGE GEAR BOX -- Model A

PLAIN CHANGE GEARS - Models & und C Lather

The quality that is built into South Bend 9-inch Precision Lathes enables them to produce quality work with efficiency under all conditions. Regardless of the type of machining - between-centers, collet, fixture, or chucking - close tolerances can be maintained and a maximum volume of fine work produced with a minimum of effort.

Write for Catalog 9-J which fully describes and illustrates all South Bend 9" Precision Lathes and attachments.

SPEED PRODUCTION WITH THESE ATTACHMENTS

COLLET ATTACHMENTS-Handwheel and Handlever types for toolroom and production work. Collet capacities from 1/16" to 1/2" by 64ths.

TAPER ATTACHMENT - For tuming or boring tapers up to 3-1/2 inches per foot.

MILLING ATTACHMENT - Mounts on compound rest base for milling, boring, and keyway cutting operations.

ELECTRIC GRINDER - Powerful external grinding attachment for shorpening reamers and cutters, cylindrical grinding, etc.

HANDLEVER BED TURRET - For volume production of small duplicate parts. Hexagon turnet head holds six tools.

DOUBLE TOOL CROSS SLIDE -Handlever or screw feed operation. Holds 3 cutter bits.

SQUARE TURRET -- Mounts on cross slide. Holds 4 cutting tools for repetitive operations, Indexes accurately. Lever operated turret

ALSO-Collet rack, center rest, follower rest, carriage stops, thread cutting stop, face plates, centers, chucks, dogs, tools, etc.



456 EAST MADISON STREET SOUTH BEND 22, INDIANA

288 SCIENCE

AUDELS REFRIGERATION &

AIR CONDITIONING GUIDE. . . . \$4
New from Cover to Cover—1280 Pages, Fully lilius, Covering basic principles, servicing, operation & repair of bousehold, commercial & industrial refrigeration & air conditioning. A gold mine of essential important facts for engineers, servicemen, users.

AUDELS CARPENTERS & BUILDERS GUIDES-4 Vols.56

A practical illustrated trade gasistent on modern construction for carpenters, joiners, builders, mechanics and all weedworkers. 4 val., 1600 pages, 2700 illustrations, flexible covers. Pocket size. Each volume sold separately \$1.50 a vol.

AUDELS AUTOMOBILE GUIDE.....54
A practical quick ready reference book for auto mechanics, service non, operators & owners. Explains theory, construction & servicing of modern motor cars, trucks, buses & auto type Diesel ongines. 1540 pages, fully illustrated, 55 chapters. Indexed. & standard book for mechanics. New fluid drive covered.

AUDELS DIESEL ENGINE MANUAL.\$2

A practical, concise treatise with questions and answers on the theory, operation and maintenance of modern diesel engines including General Motors 3 cycle Diesel, 354 pages, fully illus., flexible binding, pocket size. All details plainly brought out, this book is of extreme value to engineers, operators & students.

AUDELS PLUMBERS & STEAMFITTERS
GUIDES—4 Vols.
A Practical Trade Assistant & Ready Reference. Explains in plain
language & by clear illustrations, diagrams, charts, graphs, plejures principles of modern plumbing practice including Marine
Pipe Fitting and Air Conditioning. 4 Vols.—1670 Pages—1812
Diagrams. Pocket size. Each Vol. Sold Separately \$1.50 a Vol.

AUDELS SHEETMETAL WORKERS
HANDY BOOK
Practical inside information, Fundamentals of Sheet Metal Work,
\$88 pages, Illustrated, 11 sections, Clearly written, Essential &
important facts, figures, pointers in everyday language, Ref. Long.

AUDELS SHEETMETAL
PATTERN LAYOUTS
Developed by Experts for Sheet Metal Workers, Layout Mon & Machaniet, A Practical Encyclopedia in 10 Sections, size 7 z 10 g 2—1128 Pages—350 Layouts—1600 Hisstrations, 1001 Key Facts, Fully indexed for ready reference in answering your layout problems. Covers all phases of sheet metal work including Pattern Cutting, Pattern Development & Shop Pressure.

AUDELS NEW MACHINIST & TOOLMAKERS HANDY BOOK. \$4
Covers modern machine also practice in all its branches. 5 practical books in 1. New from cover to cover. Tells how to set up & operate latine, server and milling machines, stapers, drill presset and all other machine tools. 1600 pages, fully illustrated, 5 x 6 kg x 2. Indexed, 5 sections, 1—Modern Machine Shop Practice, 3—Rive Priot Reading & How to Draw, 2—Calculations & Mathematics for Machinelsta. 4—Shop Physics, 5—How to Use the Slide Rule. 60 chapters, Easy to read and understand. A shop companion that answers your questions.

AUDELS MATHEMATICS & CALCULATIONS FOR MECHANICS \$2 Afathematics for home study or reference. Too pages, \$50 lilius. Fractical mathematics from beginning. How to figure correctly, Easy, correct methods covering a complete review, III. & Indused.

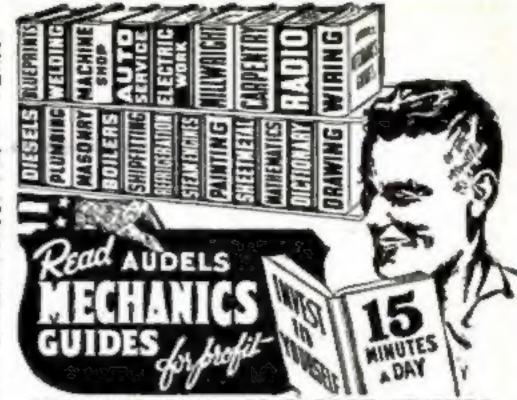
AUDELS HANDY BOOK OF
PRACTICAL ELECTRICITY 54
For maintenance engineers, electricians & all electrical workers,
1440 Pages, 2600 Illus. Covers important electrical information
in handy form—including Marine Wiring, Radio Principles,
Walding, Indexed. & Ear to a practical understanding of electricity.

AUDELS RADIOMANS GUIDE. \$4
A key to the practical understanding of radio including Frequency
Modulation, Television, etc., Aircraft & Marino Radio. For radio
engineers, servicemen, anatours. 772 pages. 400 Hustrations &
Diagrams. Photos. Review Questions & Answers, Reference Index.
Authorities plant accounts. Authentia, clear, coorise.

AUDELS ELECTRONIC DEVICES. . 52
Tells What You Want to Know About Electric Eye. Easily Understood. Covers photo-electric cells & their applications. Amplifiers,
illumination, frequencies, voltage, photocall, tubes. Ohm's Less,
wiring discrepase, etc. wiring diagrams, etc.

AUDELS WELDERS GUIDE. \$1
A concise, practical text on operation & maintenance of all walding mechanics for all mechanics. Over 400 pages, illustrated. Covers all methods of electric and acctylence weiding including airplane work.

AUDEL, Publishers, 49 W. 23 St., N. Y. I



AN AUDEL GUIDE IS A GOOD FRIEND!

Use the brains and experience of others in these Guides of the Trades, Save time and money with right methods, short cuts, labor saving Ideas, CHECK NOW! You can look over any Audel Guide in your home, Start the Easy Payments if satisfied,

THEO.AUDEL & CO., 49 W. 23 St., New York 10, N.Y. Please mail me for 7 days' free examination the books

marked (X) below, I agree to mail \$1 in 7 days on each book or set ordered, and to further mail \$1 a month on each book or set ordered until I have paid purchase price.

If I am not satisfied with Guides I will return them.

DAudols OIL BURNER G	UIDE					. 5 5	si.
☐Audels REFRIGERATIO	IN & Al	r Cond	lition	ing	Build		4
DAUGHS POWER PLANT	ENGIN	IEERS	CUI	DE .			4.
CAudols PUMPS, HYDRA	ULICS	BAIR	COMI	PRE	850 F	ts.	4
DAudels WELDERS GUID		2 8 .		* .			1
CAudels BLUE PRINT RI				9 .	. 2		2.
DANGOL SHEET METAL	WORKI	ERS H	indy	Book	8 9	4	3.
CAudols SHEET METAL	PATTE	RN LA	YOU	rs .			4.
CAudels AIRCRAFT WOR	RKER			N . 1	- 5		1
Audols MATHEMATICS	and C/	LCUL	ATIO	NS:		1	2,
Audela MACHINISTS &	TOOL	MAKEI	RS 14	endy	Box	rike .	4
DAUGHS MECHANICAL E	Netlona	ry					4
Audels AUTOMOBILE (4.
Audels DIESEL ENGINE							2,
Audels MARINE ENGIN	EERS !	landy i	Book	20 1			4.
Audets SHIPFITTERS H				. 4			1
Gueths MECHANICAL	DRAWI	NG CO	WIRE	E 1			1.
Rogers DRAWING and	DESIGN			S . 1			2.
□Audels MILLWRIGHTS	and Me	ichanii	ce Gu	ide;		4	4.
CAudols CARPENTERS of	nd Buil	ders G	aldes	(4.1	rofe.)	1	6.
Audels PLUMBERS and	Steamy	litters	Guid	es (4	weak	4)	6.
Audels MASONS and Bu	allders (Geri elmo	(4 90	(s.)			6.
Master PAINTER and D	ECORA	TOR .		2 4			2.
DAudels GARDENERS &	CHOM	ERS G	UIDI	23. (4	vet	8.)	6,
Audels ENGINEERS &	FIREM	ANS E	XAM	INA:	1101	45	3.
☐Audels ENGINEERS and	i Mechi	inies G	uide				
Nos. 1, 2, 3, 4, 5, 6, 7 a	nd E co	mpleto		2 3		. 2	2
DAudels Answers on Proc	tical EN	GIME	ERIN	e ;			1,
Audels ELECTRICIANS	EXAMI	MATIC	1648	2 4			з.
Audels WIRING DIAGR	AMS_	2.8.3		7 3		4	1,
Audels Handy Book of P	RACTI	CALE	44.61	RIC	ITY	4	4.
Audels ELECTRICAL PO	DWER C	ALCU	LATI	ONS			2.
Audels ELECTRONIC D	EVICES						2,
Audels ELECTRIC Dieti	onary				- 4		2.
Audets RADIOMARS GI	HDE	Sec. 2. 2	.3	. 3	. 2		4,
Audels NEW ELECTRIC	LIBRA	MY at	51.5	II)	Volte	7510	
Vols. I, II, III, IV, V,	Ar' Att	, viii,	IX,	х, х	u, x	\mathbf{n}	
4							

Name	
Address	
Occupation	
Employed by	945

Your T-zone" WILL TELL YOU!

T for Taste...

T for Throat ...

That's your own proving ground for any cigarette

VES, the "T-Zone" is your I own critical laboratory for any cigarette. That's where you learn by actual smoking experience the particular cigarette that suits you best.

For your taste and your throat are individual to you. Only your taste and throat can decide which eigarette tastes best to you ... and how it affects your throat.

Try Camels. See how your properly aged tobaccos, See how your throat reacts to the delightfully cool mild-

taste responds to the rich, full flavor of Camel's choice, ness of Camels.

According to a recent Nationwide survey:

More Doctors smoke Camels than any other cigarette { When 113,597 doctors were 23ked by three independent research organizations to name the cigarette they smoked,

B. J. Reynolds Tabseco Co., Whiston-Salem, M. C.

the cigarette they smoked, more doctors named Camels than any other brand.